MODERN PLASTICS

DECEMBER 1954

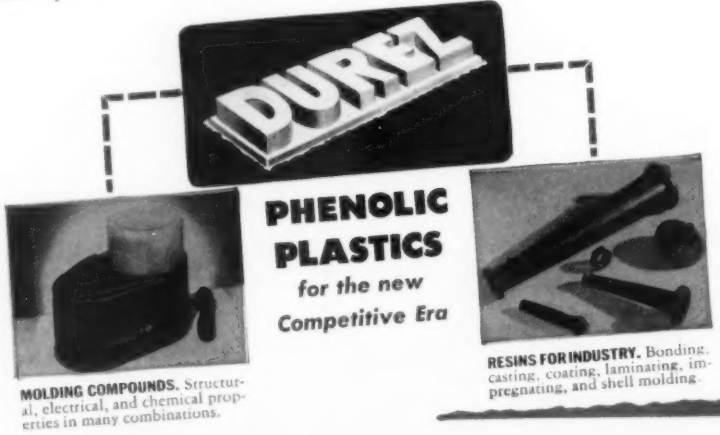
MODERN
MATERIALS
BULLETIN:

DUREZ PHENOLICS COULD BLOW PROFITS YOUR WAY

In every fie'd of industry, imaginative application of phenolic plastics creates new profit opportunities. Most versatile of all plastics materials, they are adapted to a tremendous range of engineering requirements.

In both of these air movers, for example, static and dynamic balance of a high degree are obtained with one-piece moldings. Dimensional stability and surface smoothness of the Durez phenolic assures quiet operation of fan propeller—and sizes run up to 35" in diameter. Besides true balance, the clothes dryer blower wheel meets unusual requirements of corrosion and moisture resistance — molded-in contours remain smooth through years of home laundry service.

Whether or not you have used phenolics before, an inquiry into Durez developments could reveal a new way to add product appeal, or to make a process more efficient. A call to Durez brings 33 years of specialized phenolics' experience to your problem. Write for our monthly assembly of new ideas, "Plastics News". . . Durez Plastics & Chemicals, Inc., 1212 Walck Road, North Tonawanda, N. Y.



MOLDING COMPOUNDS. Structural, electrical, and chemical properties in many combinations.

RESINS FOR INDUSTRY. Bonding, casting, coating, laminating, impregnating, and shell molding.

Rx .. *Catalin* High-Impact Styrene . . . product-vitamin!

With the wider spread of competition threatening—give thought to a preventive safeguard. Inject your product with CATALIN *High-Impact Styrene!* The many-times-higher strength factor formulated therein extends product latitude—at less cost. You'll do well to consult your molder now. Exchange your 1955 product ideas with him. His *materials* know-how will help you beat competition to the punch!

Apropos this thought is the new adding-machine housing* pictured. It embodies the *plus* in product-planning born of molder and manufacturer get-together. Injection molded of CATALIN *High Impact Styrene,* it gives polish, stature and importance to its "General". Uniform-sleek, it is smooth, smart, sturdy . . . and an exterior salute conducive to pre-selling the advanced efficiencies assembled within!

Members of the Catalin staff will gladly direct you to molders capable of performing competition-proof inoculations. Don't delay your inquiry.

* *Molded for General Computing Machines Corp., N. Y. by Majestic Molded Products, Inc., Bronx, N. Y.*

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE • NEW YORK 16, N. Y.

CATALIN

In addition to Styrene Molding Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, Melamine and Styrene Resin formulations

MODERN PLASTICS*

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Modern Plastics, published monthly by Breskin Publications, Inc., at Emmett St., Bristol, Conn. Modern Plastics Encyclopedia Issue published as second issue in September by Plastics Catalogue Corp., at Emmett St., Bristol, Conn. Executive and Editorial Office: 575 Madison Ave., New York 22, N. Y. Entered as second class matter at the Post Office at Bristol, Conn., December 14, 1950, under the Act of March 3, 1879. Modern Plastics is regularly indexed in Industrial Arts Index and Industex. Subscription rates: U.S., its possessions, and Canada, $6.00 for one year, $11.00 for two years, $15.00 for three years; Pan-American countries, $8,.00 for one year, $13.00 for two years, $17.00 for three years; all other countries $12.00 for one year, $20.00 for two years, $28.00 for three years, payable in U.S. currency. Single copies $0.75 each in the United States, its possessions, and Canada; all other countries, $1.25 (except the September Encyclopedia Issue, which is not sold separately). Printed in the U.S.A., by Hildreth Press, Inc., Bristol, Conn.

Another new development using

B. F. Goodrich Chemical *raw materials*

B. F. Goodrich Chemical Company does not make this feeder. We supply only the Geon resin for the rigid vinyl plastic.

All rigid vinyl feeder handles sulfuric acid 24 hrs. a day

THE feeder shown here supplies a steady flow of concentrated sulfuric acid to a production process. It is in use 24 hours a day, 7 days a week, yet has required no maintenance or repairs after more than 6 months of this severe service.

This marvelous record of trouble-free operation is due to the outstanding corrosion resistance of Geon rigid vinyl from which all parts of the feeder, except the motor, are made. Similar feeders made from other materials frequently broke down in service causing production delays and creating hazards to operating personnel.

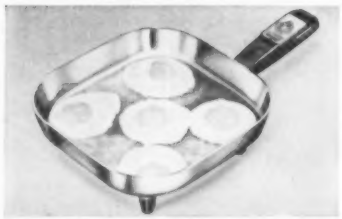
This success story of Geon rigid vinyl is one of many in which this unique material is setting new records in industry for handling corrosive materials. Furthermore, Geon rigid vinyl is tough, strong and has excellent electrical properties.

This all rigid vinyl feeder may give you an idea for an equally successful application. There are scores of uses for Geon vinyl materials—from rigid sheets and panels to flexible upholstery, wire insulation, vinyl sponge and many more. Helpful technical information is yours for the asking. Please write Dept. GB-12, B. F. Goodrich Chemical Company, Rose Bldg., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable.

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

3 DIFFERENT PLASTICS...
3 DISTINCT MOLDING PROBLEMS... *tell the inside story of Sunbeam Controlled Heat*



The SUNBEAM Fry Pan: an outstanding example of product beauty and efficiency.

How many years of molding experience . . . what special equipment and engineering skills did it take to work this problem out? SUNBEAM knew . . . and promptly picked Chicago Molded.

The unique phenolic handle of SUNBEAM's Fry Pan contains the electrical controls, is insulated against heat and is designed to keep the electrical connections dry even when the pan is dunked in the dishpan. (Note how the stainless steel tubes are molded right into the handle.) Another excellent example of plastic molding around metal is the nylon head on the cam control. And last, but not least, the escutcheon plate, complete with dial numbers, is injection molded of flame-resistant cellulose acetate.

The three molded plastic components in this SUNBEAM Fry Pan show how Chicago Molded's unequaled experience can be combined with your product design to produce a real sales headliner. Our engineers are available on short notice and without obligation. Why not call them in today? Or, as a starter, send for descriptive literature.

CHICAGO MOLDED
PRODUCTS CORPORATION
1046 North Kolmar Avenue
Chicago 51, Illinois
CUSTOM MOLDERS OF ALL
Plastics
Member, Committee on
Large Plastics Moldings, SPI

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EDITORIAL

End-User Interest in Plastics

Possibly the most significant industrial trend in relation to plastics in the year just closing was toward both broader and more specific interest on the part of end-user industries.

End-user industry's attendance at the National Plastics Exposition, at both the S.P.I. and the S.P.E. General Annual Conferences, at sectional conferences such as the Reinforced Plastics Meeting, and even at chapter conferences was far above that seen in previous years.

The invited platform participation by representatives of the plastics industries at conferences of end-user industries also was greatly increased this year. Plastics engineers and technologists appeared on at least 16 panels before conferences of end-user industries. To mention a few: The Producers' Council featured plastics in a three-day conference; 17 papers on plastics were delivered at the conference of the American Chemical Society; much of the A.M.A. Packaging Conference was devoted to the use of plastics; the A.S.T.M. meeting brought closer cooperation between that august body and the plastics societies; the A.S.M.E. in New York had a whole series of weekly symposia on plastics; a two-day Conference on Applications of Radioactivity in the Rubber and Plastics Industries was held in Boston; a big Conference on Plastics in Building was held in Washington.

Upcoming for 1955 are many more end-user industry conferences at which plastics will be firmly featured. An example is the session on Plastics in Truck Bodies to be held under S.A.E. auspices in January.

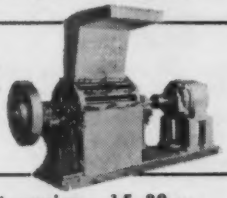
This trend toward both broader and more specific end-user interest in plastics bodes well for the industry's outlook not only for 1955 but for many years to come. It is to be hoped that the plastics industry — at the levels of both materials maker and processor — will participate in these end-user conferences; will contribute speakers, exhibit material, and ideas; and will attend with a view to learning as well as teaching. While there are many common areas of application problems in all end-user industries, each field has specialized problems in the use of plastics.

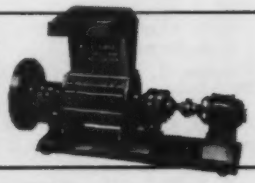
The breadth of industrial interest is as big as the combined prospect lists of all companies engaged in plastics manufacture and processing. The refrigeration, home appliance, automotive, railroad, electronics, building, textile, business machines, aviation, and many other industries are on these prospect lists. And while individual salesmen and the visiting engineers calling on individual prospects can accomplish much, there are great opportunities for the study of each industry's application problems in plastics in an atmosphere of concentrated and mutual interest. Indeed, so diverse are the interests and problems of these end-user customers and prospects, that certain kinds of progress can be made only under such specialized circumstances.

It is to be hoped that this trend toward increased plastics industry participation in engineering and other conferences of end-user industries will be encouraged.

how to pick the right granulator for your needs

IF YOUR MATERIAL IS LIKE THIS	AND YOUR CAPACITY NEEDS ARE LIKE THIS	YOU NEED THIS B&J GRANULATOR
Gates, sprues, runners, rejects, etc., from ⅛" to ½" sectional thickness	up to 75 lbs. per hour	**MIDGET**—5½"x6" throat opening —1 HP motor—2 models, with bin, or to granulate directly into a drum —18" x 22" floor space
Large sprues and runners, and small rejects	up to 150 lbs. per hour	**LABORATORY 251** — 8" x 8" throat opening — 1½ or 2 HP motor — granulates directly into a drum or bin
Accumulated average scrap—large sprues, runners, medium area rejects	up to 250 lbs. per hour	**STANDARD IDEAL**—3½" x 10" throat opening —2 or 3 HP motor—Model 301 has 6" x 10" throat opening
Accumulated scrap of tough dense materials and small bleeder scrap	up to 250 lbs. per hour	**HEAVY DUTY IDEAL**—3½" x 10" throat opening—5 HP motor—Model 351 has 6"x10"throat opening
Tough scrap, purges or rejects and large area scrap	up to 500 lbs. per hour	**No. ½ HD**—8" x 20" throat opening—15 HP motor—features breaker knife at top of cheek piece. This is our sturdiest medium size machine.
Accumulated runners, sprues, tough scrap, purges, etc.	up to 750 lbs. per hour	**No. 1** — 7" x 24" throat opening — 10 or 15 HP motor
Tough scrap, purges, lumps, virgin slabs, etc.	up to 1200 lbs. per hour	**No. 1½** — 8" x 26" throat opening — 15, 20 or 25 HP motor
Virgin slabs, large lumps, purges and large rejects	up to 1800 lbs. per hour	**No. 2** — 3 models — 28"x10", —18"x10" or — 12"x10" throat openings — 25 to 60 HP motor





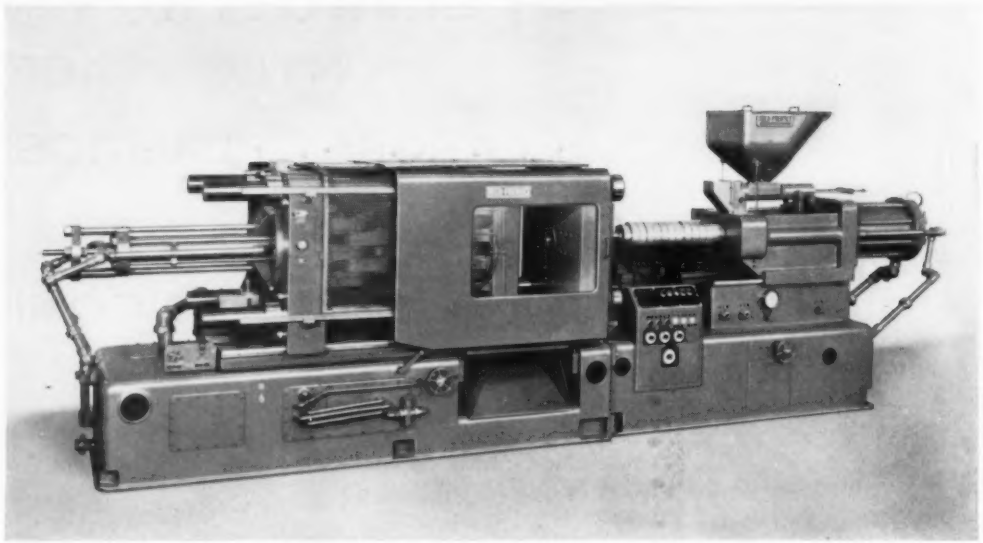
This is a partial listing of our extensive line **— there are additional models to meet every requirement. Tell us your requirements and send samples of your material for grinding in our testing laboratory. After thorough test grinding and analysis we will recommend the machine best suited for your purpose.**

BALL & JEWELL, INC.

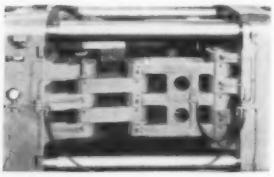
Leaders in Granulating Machinery for a Half Century

22 FRANKLIN STREET **EVergreen 9-6580** **BROOKLYN 22, NEW YORK**

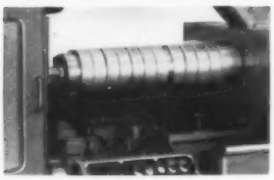
NEW 400T-16/20 oz. "REED"



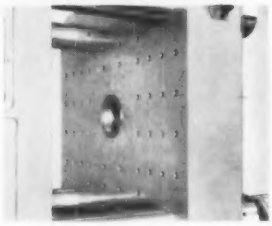
extra molding capacity through multiple strokes



400 TONS CLAMPING PRESSURE
Powerful toggle mechanism develops 400 tons positive mechanical mold locking pressure to hold large area jobs.



HIGH PLASTICIZING CAPACITY
Newly designed heating cylinder plasticizes 125 lbs. of thermoplastic material per hour and simplifies heater maintenance.



36" x 38" MOLD PLATENS
Four tie bars, 4½" diameter each, support large mold platens which give projected casting area of 200 sq. in.

New! Reed-Prentice introduces the new 400T-16/20 oz. plastic injection molding machine, engineered to combine "REED" ruggedness with speed and *extra molding capacity*. A new built-in stuffing arrangement produces shots above the rated capacity of 20 oz. through multiple strokes.

And the 400T-16/20 oz. "REED" gives you greater production. It dry cycles at 250 shots per hour. Optional low pressure die closing unit assures mold protection in full automatic operation.

FREE! Want full details on the 400T-16/20 oz. "REED"? Write today for Bulletin 1620.

The world's largest builders of plastic injection molding machines

REED-PRENTICE CORP.

MAIN OFFICE: 677 Cambridge St., Worcester 4, Massachusetts

REPRESENTATIVES: Houston — Steel & Machine Tool Sales Co.; Seattle & Spokane — Star Machinery Co.; Minneapolis — Chas. W. Stone Co.; Los Angeles — Western Molders Supply Co.

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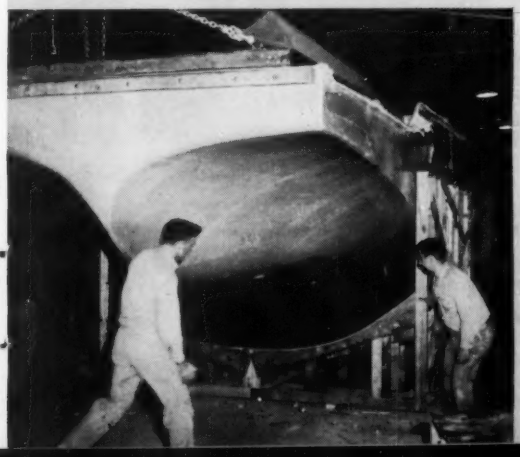
the World's Largest plastic molding is...

51 FEET OF LIGHTWEIGHT RIGIDITY

• Removing forward section from mold.

Preparing after section for
• assembling with hopper section.



NEW ARMY BARGE—MOLDED OF MARCO† THIXOTROPIC RESIN—CAN CARRY UP TO 5 TONS OF CARGO

BSPI-6671 is an Army barge, self-propelled, inland. It weighs about 10 tons, carries about 5 tons of cargo. It draws only 21 inches. It won't rot or corrode, requires no maintenance. It's heavy duty—yet low in cost.

That's what this barge is to the Army. To industrial designers and engineers, it's a crowning example of large area molding now possible with Celanese* MR† polyester resins.

Produced in sections by hand lay-up, the barge hull utilizes the unique non-draining properties of Marcothix† Resin on vertical and curved surfaces. Like other out-size products now being molded of reinforced Marco resins, BSPI-6671 resists weather, moisture, heat, cold, vibration, high impact, and stress. Color can be molded in during curing. Patch repairs can be made simply and quickly.

If you want lightness with strength, freedom in design, and construction simplicity on a grand scale—let this barge launch you in the right direction. For literature describing the possibilities of Celanese MR resins, write

Celanese Corporation of America,
Plastics Division, Dept. 101-L,
290 Ferry Street, Newark 5, N. J.
Canadian affiliate,
Canadian Chemical Company Ltd.,
Montreal and Toronto.

Celanese*

MARCO* POLYESTER RESINS

*Reg. U S. Pat. Off.
†Trademark

Striking examples of the efficiency of Battenfeld's Injection Moulders

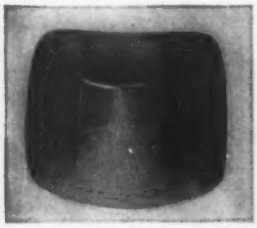
BATTENFELD

ONCE AGAIN THE BIG HIT

IN FULLY AUTOMATIC INJECTION MOULDING

AT THE Industrial Fair Hannover

April 25th - May 4th 1954

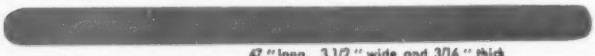


28 oz. in plexigum
manufactured in W-Germany

18 oz. in polyethylene
manufactured in Belgium

18 oz. in polyethylene and polystyrene
manufactured in W-Germany

13 oz. in nylon
manufactured in Switzerland



14 oz. in nylon

47 " long, 3.1/2 " wide and 3/16 " thick
manufactured in W-Germany

ELECTRO-MECHANICAL DRIVE + PNEUMATIC FOLLOW-UP PRESSURE
with built-in experience and advanced modern engineering

BATTENFELD builds this range

Horizontal

BSM	20 S	0.7 oz.
BSM	40	1.4 oz.
BSM	40 S	1.4 oz.
BSM	100	3.5 oz.
BSM	100 S	3.5 oz.
BSM	160	5.7 oz.
BSM	300	10.7 oz.
BSM	450	16 oz.
BSM	450 Sp	16 oz.
BSM	800	28 oz.
BSM	1000	36 oz.

S – Speedy
Sp – Special construction

Vertical

BSM	20 V	0.7 oz.
BSM	40 V	1.4 oz.
BSM	100 V	3.5 oz.
BSM	160 V	5.7 oz.

At the Fair with

3	BSM	40 S
1	BSM	40 V
1	BSM	100 S
1	BSM	160
1	BSM	300
1	BSM	450

and
2 Compression Moulders
50 and 100 tons pressure
and the most convincing
array of injected articles

for full particulars please apply to

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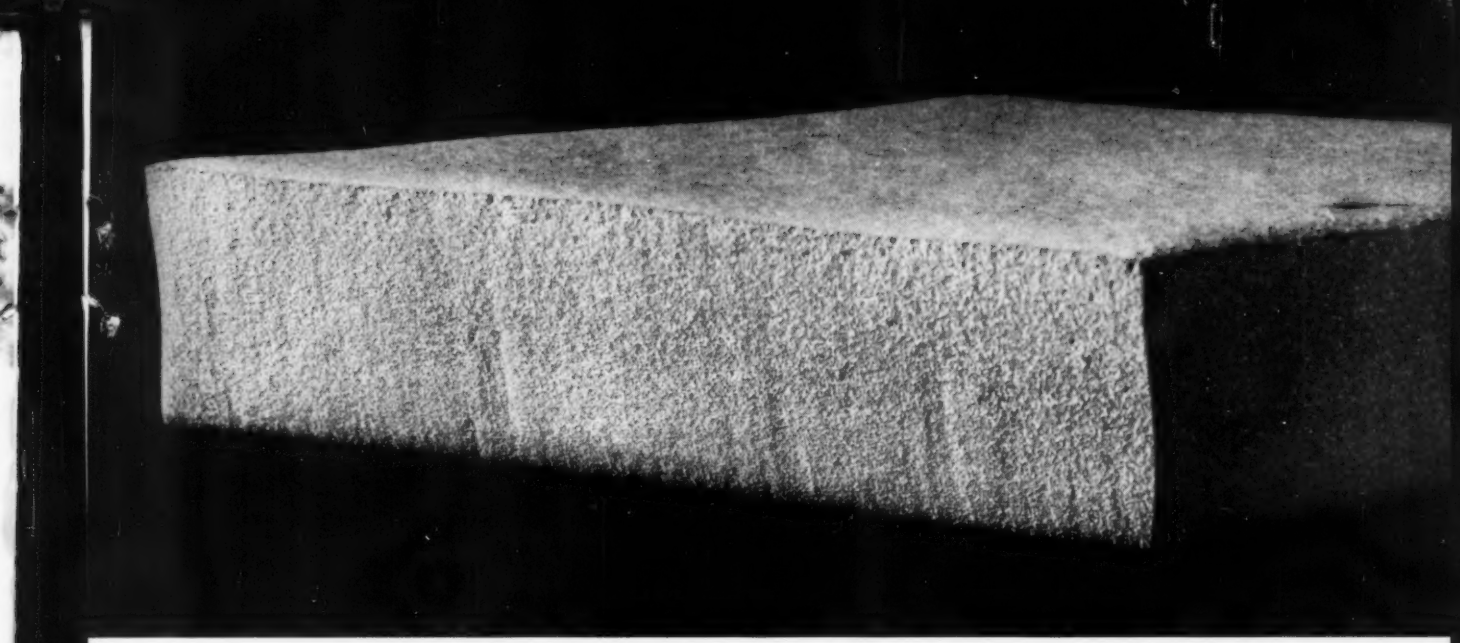


You can now make low-density polyvinyl chloride sponge at atmospheric pressure with DU PONT BL-353

This new Du Pont chemical blowing agent has the following advantages:

REQUIRES no special equipment

PRODUCES consistent results in a simple operation.

OFFERS wide latitude in formulating plastisols.

PERMITS use of low-cost extenders and fillers.

PERMITS a wide range of densities, down to less than 6 lbs./cu. ft.

PRODUCES soft resilient sponge, supported or unsupported, up to several inches in thickness.

PRODUCES excellent cellular uniformity for a wide variety of cell sizes.

HAS excellent expansion efficiency.

LIBERATES large volume of nitrogen at a uniform rate.

IMPARTS no odor or color.

PRODUCES snow-white sponge.

PERMITS production of sponge in a variety of colors and shades.

PRODUCES a predominance of interconnected cells.

MAY be used in slush-molding operations.

SEND FOR FREE BULLETIN. Our new bulletin explains how BL-353 is used to make high-quality sponge that may be just what you need for your application. If you would like a free sample for experimental work, just write: E. I. du Pont de Nemours & Co. (Inc.), Chemical Sales, Explosives Department, Room 11502-N, Wilmington 98, Delaware.

Du Pont BL-353

Product of Du Pont Explosives Research

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

E. I. du Pont de Nemours & Co. (Inc.)
Chemical Sales, Explosives Dept., Room 11502-N
Wilmington 98, Delaware

Please send me a copy of your free bulletin describing the use of BL-353 in making polyvinyl chloride sponge. I am interested in using sponge for. . . . . .

*Name*_____ *Title*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____

Muscles for our air arm: lightweight parts fight heat, weather, bullets

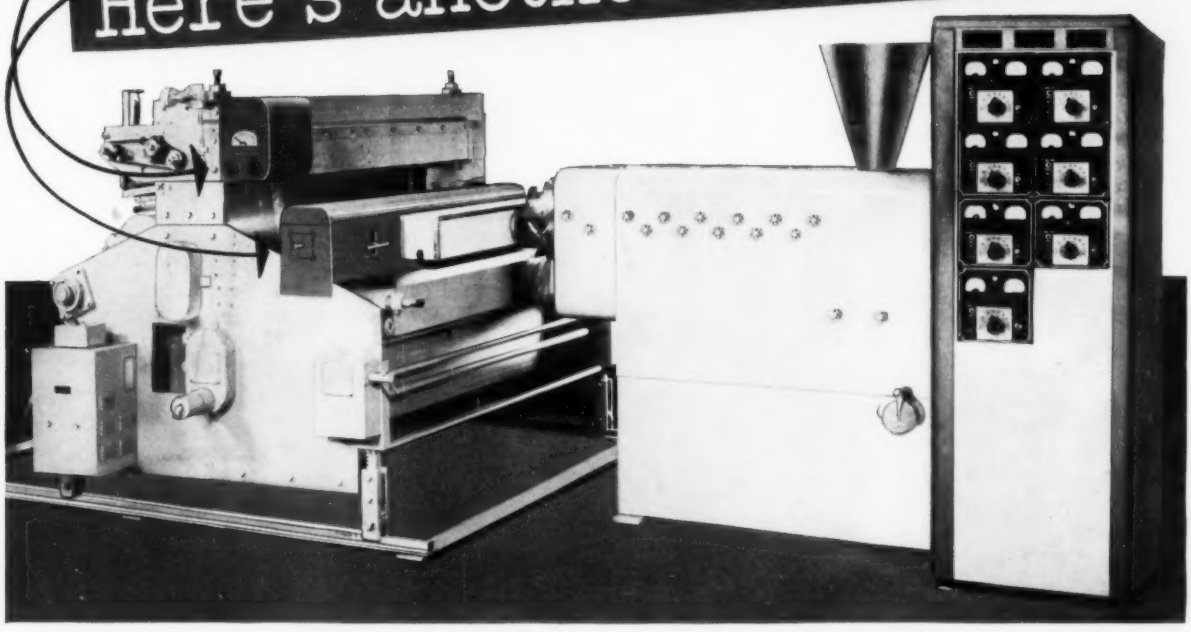
The wing tips of this Thunderstreak jet fighter-bomber are of Fiberglas*-Reinforced Plastics . . . also the radome . . . fuel cell support liners . . . exterior ice shields . . . even the engine blades! And soon—Fiberglas-Reinforced Plastics for armor that resists gun fire and shell fragments . . . as well as for primary structural members in guided missiles. And this is only the beginning!

What's *your* line? Planes? Perambulators? Plows? Whatever your product, you might make it better, safer or at lower cost by molding it of Fiberglas-Reinforced Plastics. Look into these fast growing materials now. For further information, please write: Owens-Corning Fiberglas Corporation, Plastics Reinforcement Division, 598 Madison Ave., New York 22, N. Y.

OWENS-CORNING
FIBERGLAS

*T. M. Reg. O-CF Corp

Here's another MPM First!



designed to give polyethylene a printable surface

NEW MPM-Traver unit pre-treats film electronically

● By application of a new electronic process, the MPM-Traver Pre-treatment Unit ends a problem which has long perplexed producers of polyethylene film. The unit is a simple-to-use, light-weight set-up which, at low cost, makes the surface of flat sheet or tubing printable.

The unit modifies the surface of a polyethylene film by bombarding it electronically. Yet, the other chemical and physical characteristics are unchanged. The simplicity and complete effectiveness of the MPM-Traver method outmodes other treatment systems.

The unit can be installed on the take-up, as illustrated above, to treat the film as it is extruded. Or the treatment unit can be brought to bear on the film at any subsequent time. Once treated, the polyethylene can be printed at any time by any recognized printing method.

Look at these important advantages:

- **Versatility**—will treat any extruded width of film and gauge of material
- **Simplicity**—only casual monitoring needed; easy to set up and operate
- **Safety**—interlocked for operator safety; current cuts off when threading; no fires or open flames required; complies with Underwriter's code
- **Dependability**—the unit, engineered and manufactured with the fine precision and skill that goes into every MPM product, is the most advanced pre-print treatment commercially available

MPM holds the exclusive manufacturing rights to this polyethylene pre-printing treatment equipment. You can get further information and make arrangements for a demonstration by writing the manufacturer today.

mpm modern plastic machinery corp.
15 Union St., Lodi, N. J.
cable address: MODPLASEX

West Coast Representative
4113 West Jefferson St., Los Angeles 16, Calif.

VERSATILE VINYL FOAM

is easier made with PLIOVIC

Uniformity, good foaming characteristics, a desirable fusion temperature, good heat and light stability, compatibility with modifying materials—all of which add up to ease of compounding—are the reasons for the use of PLIOVIC in IC Vynafoam.

PLIOVIC is the easy-processing vinyl resin by Goodyear. IC Vynafoam is Interchemical's name for a new series of heat-expandable plastisols that is finding application as a gasketing, insulating and cushioning material in a wide range of shapes and sizes.

Here's how it works: The initial form is a wet paste which can be poured, extruded, sprayed or cast into place. When subjected to a few minutes' heat —300-350° F.—at atmospheric pressure, the paste expands 300%-400%—then solidifies into an evenly textured foam. This foam is tough, adherent, light in weight, has good insulation and compressive properties and is resistant to oils, greases, solvents, alkalies and most acids.

Heat-expandable plastisols is just one of many uses for versatile PLIOVIC. Careful control of particle size, shape and distribution has led to the development of a whole family of resins of constant characteristics designed to help you to new or improved products, easily and economically.

Why not help yourself to more profits with PLIOVIC? Generous sample plus full technical help are yours by writing to:

Goodyear, Chemical Division,
Akron 16, Ohio

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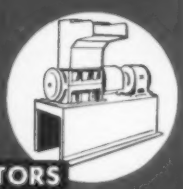
GOODYEAR
DIVISION

Use-Proved Products – CHEMIGUM • PLIOBOND • PLIOLITE • PLIO-TUF • PLIOVIC WING-CHEMICALS – The Finest Chemicals for Industry

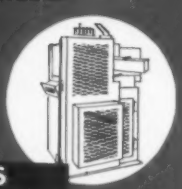
Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic – T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio
IC Vynafoam – T. M. Interchemical Corporation, New York, N. Y.

Photograph courtesy American Motors Corporation, Plant Five, and Interchemical Corporation.

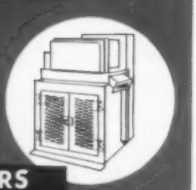
In Plastics Reducing Machinery, Look to CUMBERLAND for the COMPLETE LINE



GRANULATORS



DICERS

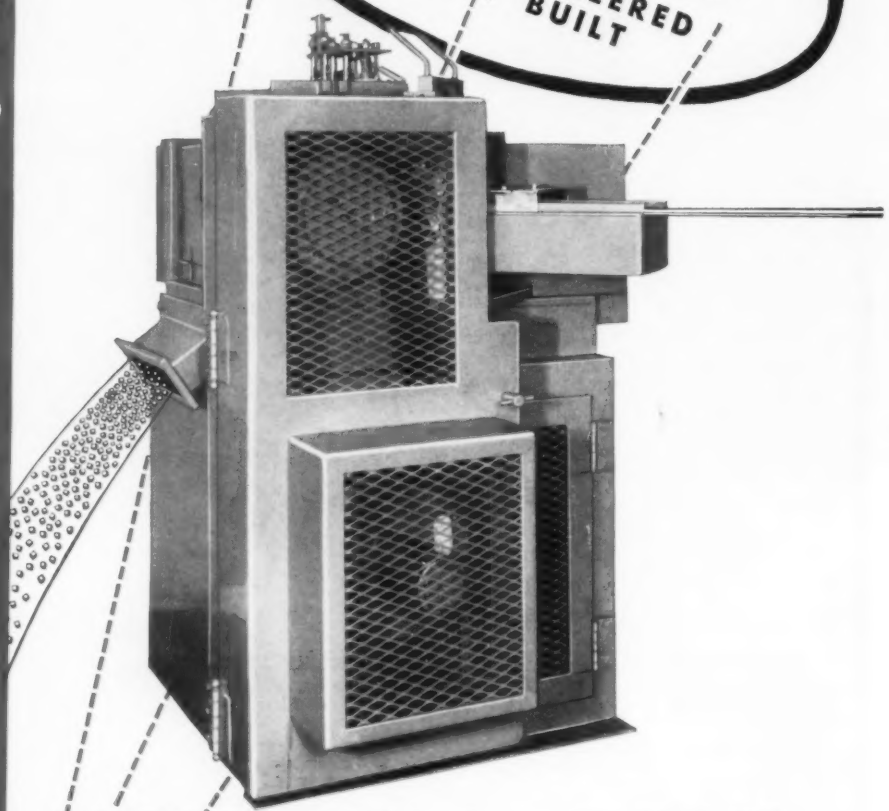


CHOPPERS

PREBREAKERS

"STAIR-STEP" Dicing Machine

CUSTOM ENGINEERED
QUALITY BUILT



1. **PERFECT CUBES** — Perfect cubes or rectangular pellets produced by simply changing knives — cube sizes from 1/16" to 1/2".
2. **DICES WIDE RANGE OF PLASTIC SHEET STOCK** — Easily handles such materials as polyethylene, soft vinyls, nylon and acetate.
3. **RUGGEDLY BUILT** — In two sizes to handle sheet stock up to 7" or 14" — Special machines built to order.

Write for complete details

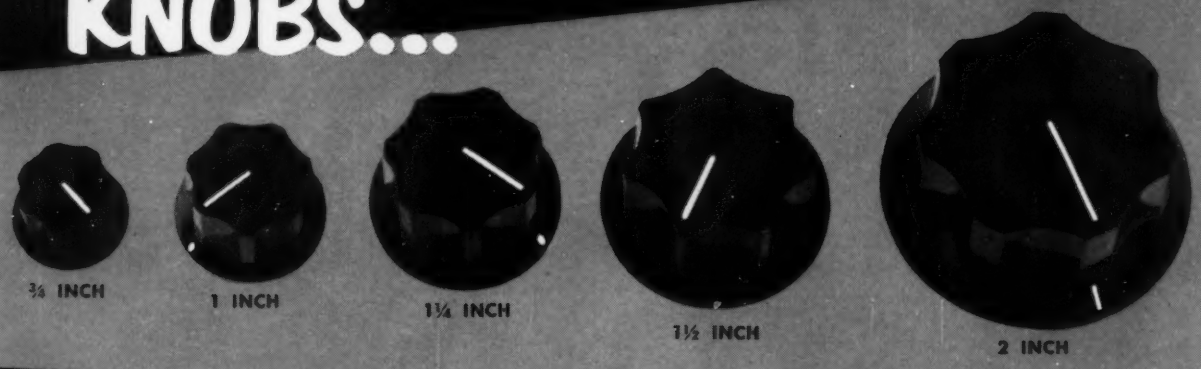
CUMBERLAND Engineering Company Inc.

BUILDERS OF BETTER MACHINES FOR THE PLASTICS INDUSTRY

DEPT. 1 · BOX 216 · PROVIDENCE · RHODE ISLAND

California Representative:
WEST COAST PLASTICS DISTRIBUTORS, INC.
4113 West Jefferson Blvd., Los Angeles 16, Cal.

KNOBS...

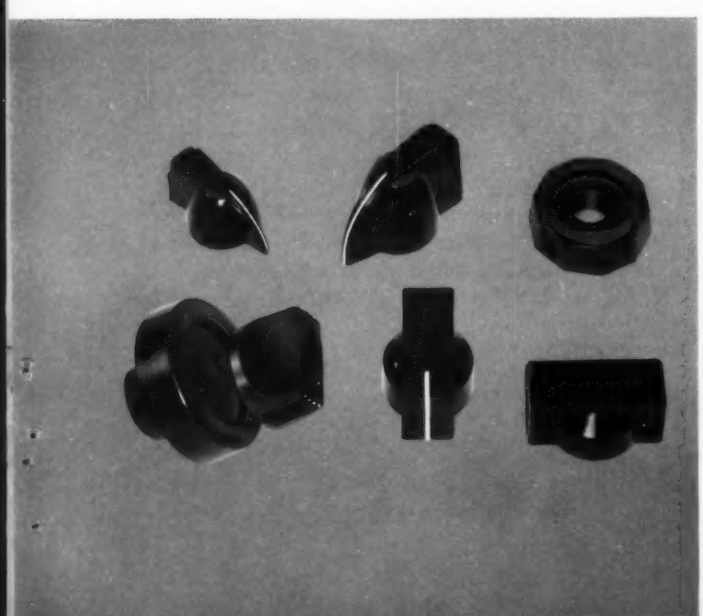


A New All-purpose Functional Design In a Standard Line of Instrument Knobs

Now, without tooling charge of your own, you can dress up your instrument line with these beautifully designed, readily available knobs by Kurz-Kasch.

Look them over! Shown actual size, dimensions given are flange diameters. All sizes have ¼" shaft holes—come with or without brass inserts—any type of setscrew (one or more). Undersides are counterbored. Color, metalized, and filled or unfilled indicator lines at your option. Here's style at a price!

Turn to Kurz-Kasch for the most complete line of standard knobs in the industry—and SAVE. Send for samples and specification data today—or request full line data on knobs not shown. Inquiries answered at once.



Don't overlook these popular Kurz-Kasch designs for bar knobs, pointer knobs and dual control vernier knobs.

KURZ-KASCH

Specialists in Thermo-Setting Plastics for 37 years

Kurz-Kasch, Inc. • 1415 S. Broadway • Dayton 1, Ohio

BRANCH SALES OFFICES: **New York,** *Mt. Vernon MO 4-4866* • **Rochester,** *Hillside 4352* • **Chicago,** *Merrimac 7-1830* • **Detroit,** • **Los Angeles,** *Richmond 7-5384* • **St. Louis,** *Parkview 5-9577* • *Trinity 3-8200* • **Philadelphia,** *Hilltop 6-6472* • **Dallas,** *Logan 5234* **Atlanta,** *Exchange 0414* • **Toronto,** *Riverdale 3511.*

EXPORT OFFICE: 89 Broad St., New York City, Bowling Green 9-7751.

DURAMOLD A USED FOR HOBBED PLASTIC-MOLDING DIES

This picture, taken in the shop of Hauser Products, Inc., Chicago, shows the manufacture of 4¼ in. square wall tile. The tile, made of polystyrene plastic, is formed in an 8-oz-capacity molding machine, at the rate of 6 tiles per cycle, or 900 tiles hourly. The steel used for the multiple-cavity die is Bethlehem Duramold A.

Duramold A was selected for this application because of its ease of hobbing, high core-strength (over 140,000 psi), minimum size-change in heat-treatment, and freedom from porosity and pits. It is providing long, economical service.

Duramold A is a chromium-type of air-hardening electric-furnace steel. It is annealed to a softness of 109 max Brinell, and can be cold-hobbed easily, even where relatively deep or large cavities are necessary.

TYPICAL ANALYSIS

Carbon 0.07 Manganese 0.40 Silicon 0.25
Chromium 4.50 Molybdenum 0.45

If you'd like to learn more about the advantages of Duramold A, please get in touch with your tool-steel distributor, or write to the nearest Bethlehem office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM TOOL STEELS

BETHLEHEM STEEL

Fabricated by Mercury Plastics Corp.

Perfect cover-up

Another Case for U.S. Royalite

A "perfect" cover for Universal Winding Co.—one of the nation's leading makers of textile winding machines—had to do *more* than just cover part of the machine.

It had to be tough enough to take constant use, a good deal of *ab*use. It had to be *tight-sealing...good-looking...free of lint-trapping areas*...and relatively *inexpensive*.

Universal found Royalite covers designed and fabricated by Mercury Plastics Corp. of Chicopee, Mass., were *all* this...*and more!*

Covers are easily formed from Royalite sheets over inexpensive tools, with no extra finishing operations required. They are much less expensive than the metal covers formerly used.

What's more, U. S. Royalite brought still other advantages. Its *integral color* matches the machine, can't chip or scratch off. It is *quiet* to handle, and deadens machine noise. Its *formability* allowed an undercut to seal out dirt. And its *flexibility* ended the need for screws or other fastening devices—the cover simply snaps in place!

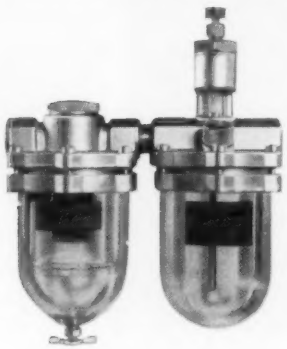
Whether *you* have a *specific* component or cover problem, or just an *idea* that a certain piece of equipment might be improved, it *will pay you to check on U. S. Royalite!*

U.S. ROYALITE®
TOUGH PLASTIC PRODUCTS

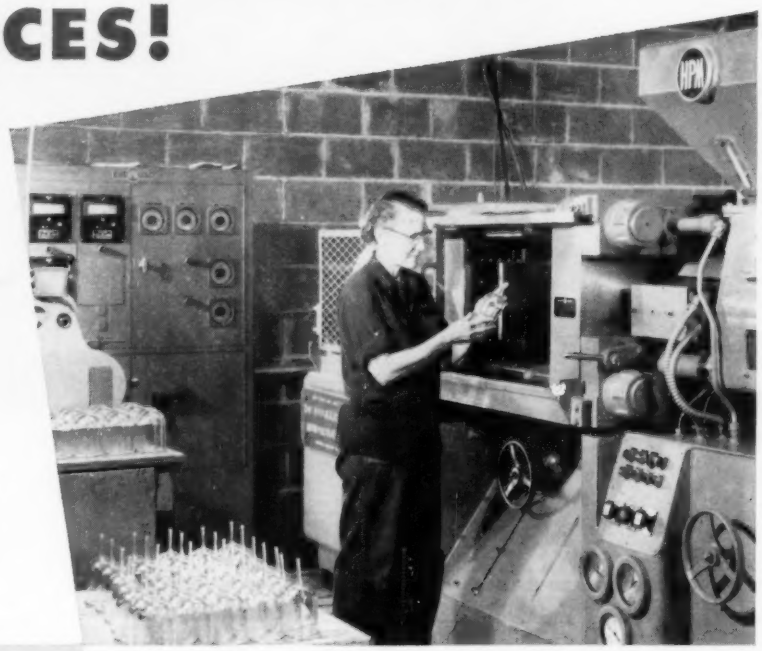
US RUBBER

UNITED STATES RUBBER COMPANY
2638 NORTH PULASKI ROAD, CHICAGO 39, ILLINOIS

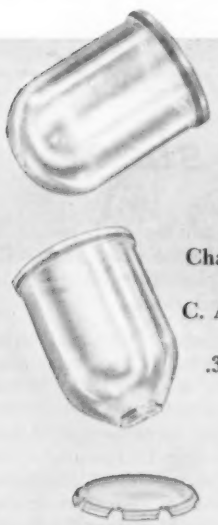
standard HPM MOLDS BAKELITE C-11 TO CRITICAL TOLERANCES!



Norgren Vitalizer Unit, a combination air line filter and oil fog lubricator. Heavy, durable, transparent bowls and baffle are molded by Chaney Plastics of Denver.



Chaney Plastics of Denver Solves Tough Production Problem with Standard H-P-M Injection Machine.

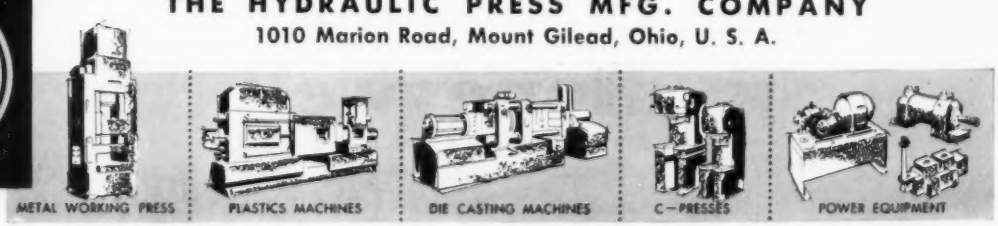


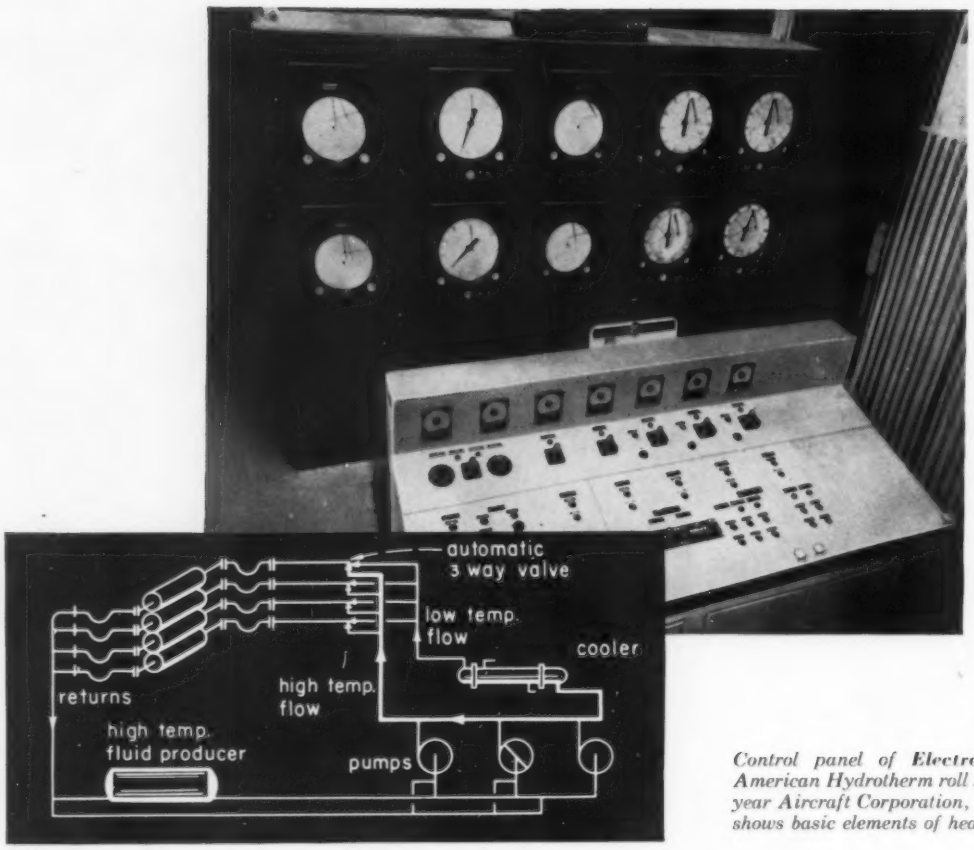
Here's one to remember . . . when quality and dimensional tolerances are critical and molded parts undergo rigid inspection, you can rely on standard H-P-M injection machines to handle the job. In this instance, the Chaney Plastic Molding Co. of Denver, installed a new H-P-M 9 oz. and within two hours after installing the dies were producing quality bowls for the C. A. Norgren Co. This, in itself, must be some sort of record, for both machine and dies were new. The bowls are designed with an 8X safety factor, are .300" thick, Bakelite C-11 material. One of the bowls has a brass insert in the bottom. Critical dimensional tolerances are maintained.

It's another typical H-P-M success story — one that may have a parallel in your plant. If you've an injection molding problem you can be sure there's an H-P-M for the job. Get in touch with your H-P-M field engineer today.

HPM

THE HYDRAULIC PRESS MFG. COMPANY
1010 Marion Road, Mount Gilead, Ohio, U. S. A.





Control panel of ***ElectroniK*** *instruments for American Hydrotherm roll heating system at Goodyear Aircraft Corporation, Akron, Ohio. Diagram shows basic elements of heating systems.*

Fractional-degree *ElectroniK* control *speeds output of vinyl sheet*

PROCESSING of vinyl sheet, at Goodyear Aircraft Corporation, demands highly precise control of temperatures of the calender rolls to get full utilization of the roll width . . . and to maintain specified conditions at high production speeds.

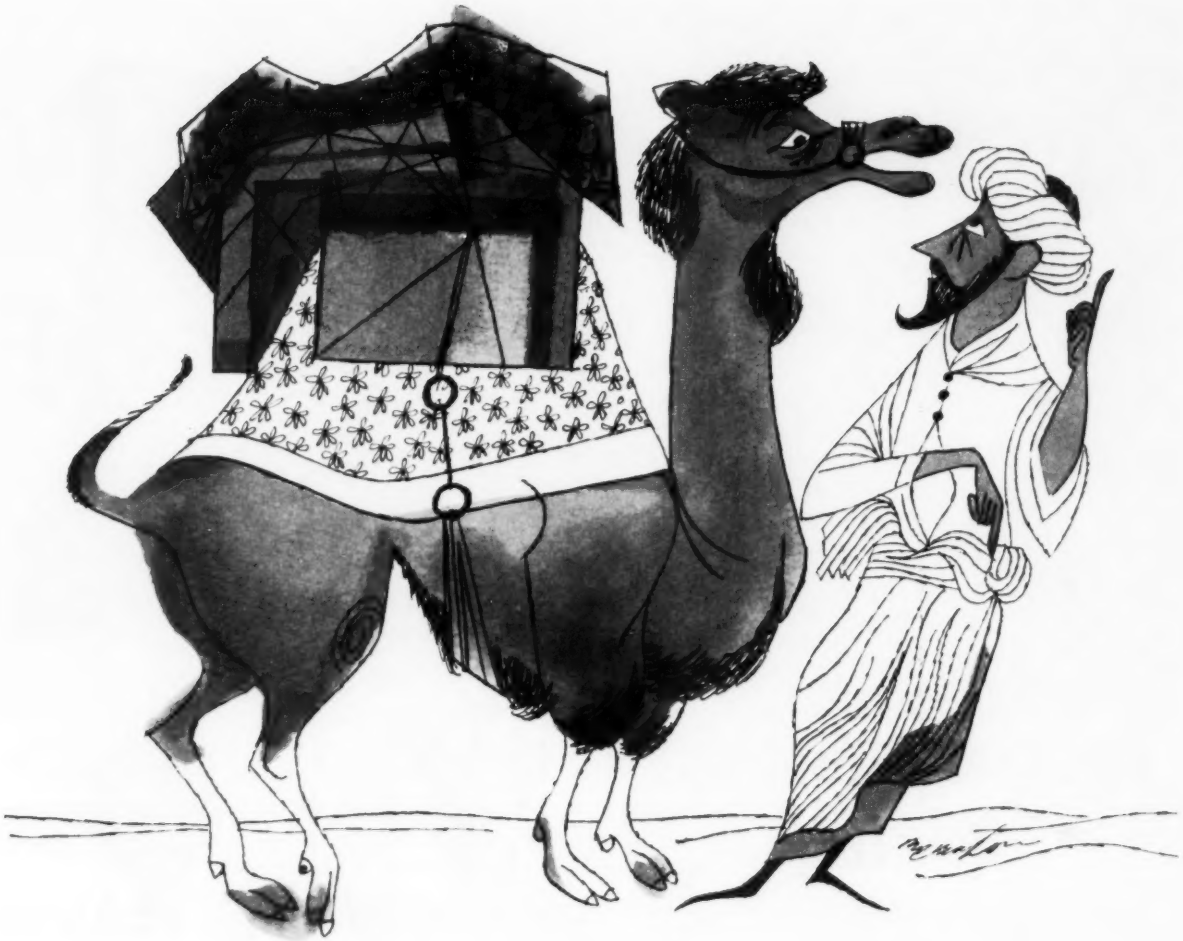
A closely integrated high-temperature heating and cooling system designed by American Hydrotherm Corporation does the trick. The system, using water heated to 360° F. and kept under pressure to hold it in the liquid state, has many advantages over steam heating. Interlocked heating and cooling systems provide a means of mixing hot and cool water as required to supply the rolls with liquid at the correct temperature. An *ElectroniK* instrument controls the blending of hot and cold water by operating three-way and two-way diaphragm motor valves in the water lines. Control is so exact that roll temperature stays consistently within ½ to 1 degree of the required value.

ElectroniK instruments and other Brown controllers are helping scores of plastics manufacturers to achieve the accurate control required for modern production methods and materials. This versatile line of instrumentation is applicable to heating systems using electricity, steam or high temperature liquids. For a discussion of your specific applications, call your nearby Honeywell sales engineer . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Catalog 1531, "*ElectroniK* Controllers."**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls



The Arab and the Camel

An Arab having loaded his Camel asked him whether he preferred to go up hill or down hill. "Pray, Master," said the Camel dryly, "is the straight way across the plain closed up?" —*Aesop*

To solve production problems... improve product performance...or add sales appeal...Plenco goes straight to the objective.

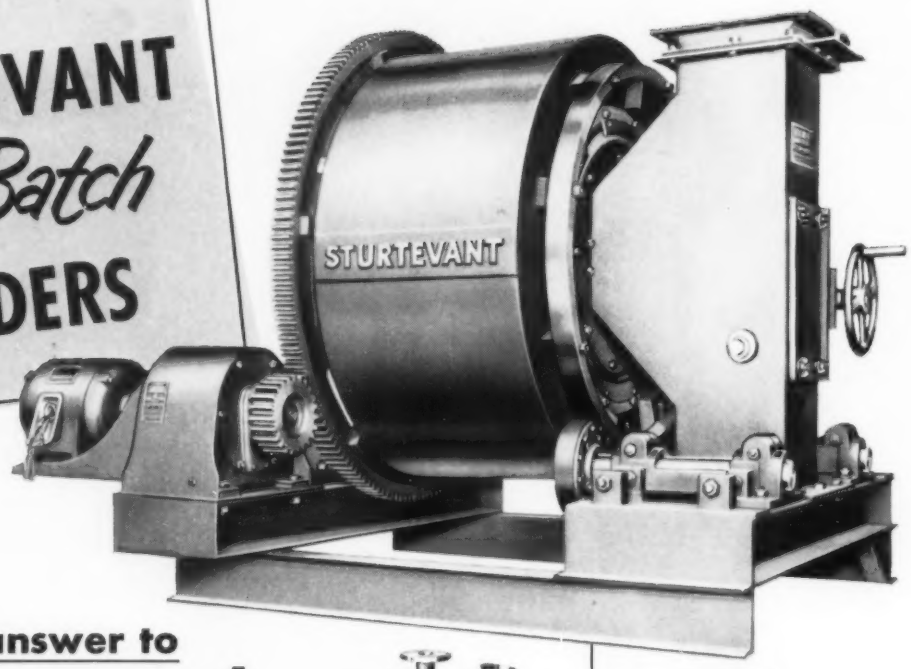
PLASTICS ENGINEERING COMPANY

Sheboygan, Wisconsin

PLENCO PHENOLICS

FOR BETTER PLASTIC PRODUCTS

STURTEVANT *Dry Batch* BLENDERS



are the answer to

Fast, Economical Mixing

Because of the unique design of its mixing chamber, and the 4-way mixing action which brings two or more substances together, the Sturtevant Dry-Batch Blender does a more rapid mixing job than other machines and, at the same time, it is complete and thorough in every particular. The substances may be of different weights and physical properties, and may be either dry, partly dry, or a mixture of both. Write for bulletin today.

Compare These Advantages

- Only one lever controls both receiving and discharging for simplicity of operation. Hand wheel operates rack and pinion slide at feed opening.
- 4-way mixing action speeds production . . . assures thorough blends.
- "Open-door" accessibility permits easy, fast, thorough cleaning.
- Single aperture drum for both intake and discharge.
- Unusually efficient scoops pick up materials to effect thorough mixing as drum revolves.
- 9 models . . . a size for every job . . . from 10 cu. ft. to 900 cu. ft. batches.

STURTEVANT MILL COMPANY

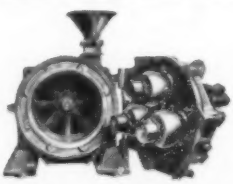
110 Clayton Street, Boston 22, Mass.

DESIGNERS & MANUFACTURERS OF

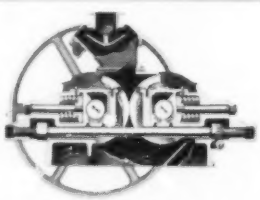
CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS AND EXCAVATORS • ELEVATORS • MIXERS

Micronizer® Grinding Machine. A fluid jet grinding machine, the Sturtevant Micronizer speeds reduction of materials to low micron sizes. These jet mills are especially applicable in fields where a particle size in microns is desired. Available for outright sale.

Air Separator — for separation of fines to 325 mesh and finer. Increases output from 25% to 300% . . . lowers power costs by 50%. Capacities ¼ to 50 tons per hour output.

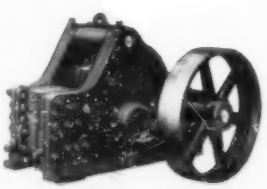


Ring-Roll Mills — for medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operated in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.

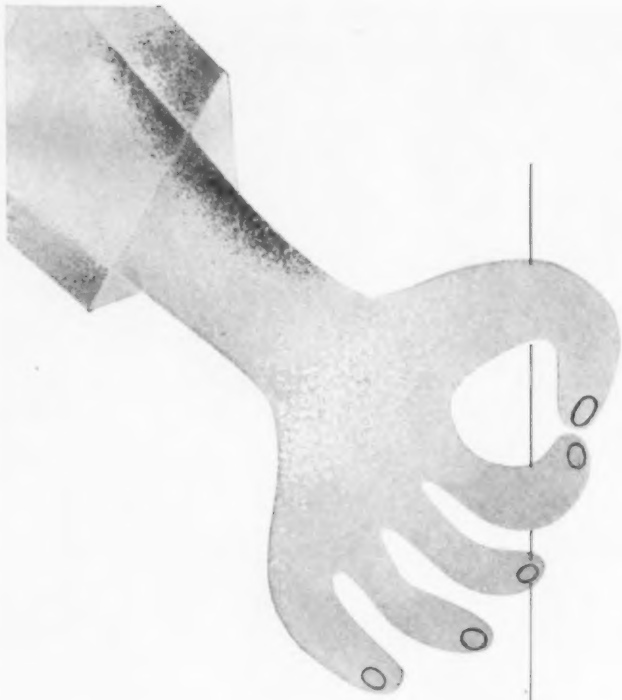


Crushing R[illegible] for granulation, coarse or [illegible] soft materials. Automatic a[illegible] Crushing shocks balance[illegible] or wet re[illegible] duction. Sizes [illegible] 20. The standard [illegible]

Rotary Fine Crushers — for intermediate and fine reduction (down to ¼"). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers.



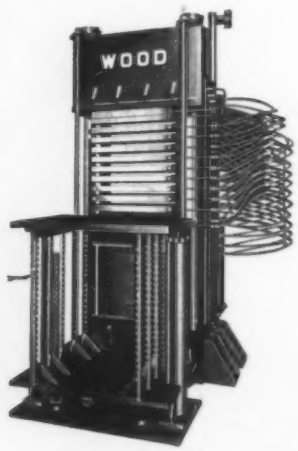
Jaw Crushers — for coarse, intermediate and fine reduction of hard or soft substances. Heavy or light duty. Cam and Roller action. Special crushers for Ferro-alloys. Several types, many sizes.



Ever measure a pinch of salt?

IN RUBBER AND PLASTICS, THE PAYOFF'S AT AN R. D. WOOD PRESS LIKE THIS ONE!

This 880-ton multiple opening platen press is designed for polishing and laminating plastic sheets. The complete ten opening sheet production unit includes a twenty opening loading and unloading elevator. R. D. Wood hydraulic presses are made in a full range of sizes and capacities, for many uses. Ask for catalog, and for engineering aid—both yours without obligation.



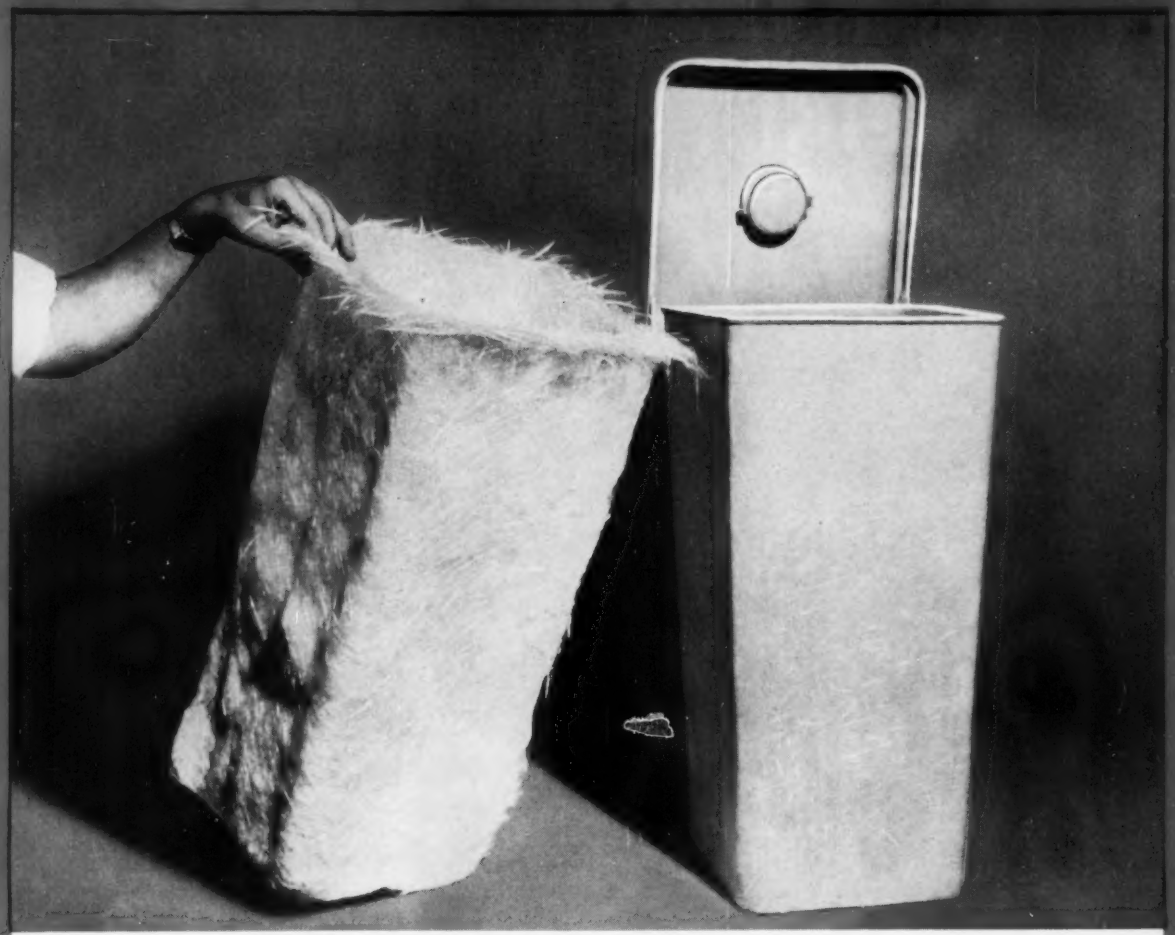
It is to be doubted whether even the most expert chef can tell the capacity of his own pinch of salt. And yet, he has a fine flair for flavor—an art which never fails him. On the other hand, in the business of making capital investment machinery such as hydraulic presses, R. D. Wood Company cannot use the pinch as a means of measurement. We have to rely on highly technical procedures. However, there *is* an art here which compares with the chef's. It's the art that comes only from having done the same thing many times before . . . sizing up a manufacturer's production need . . . building a press to meet that need . . . and doing the job so well that he never has the same problem again. We're holding an illustrated catalog for you. Please, send for it.

R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA

Representatives in Principal Cities

MAKERS OF HYDRAULIC PRESSES AND VALVES | FIRE HYDRANTS | CAST-IRON PIPE | GATE VALVES | GAS PRODUCERS | ACCUMULATORS



WHY HOLIDAY PLASTICS USES PARAPLEX MOLDING RESINS

This diaper hamper, molded in one piece except for the lid, is one of a whole range of durable, attractive items produced by Holiday Plastics with the aid of Rohm & Haas PARAPLEX "P" resins. Holiday Plastics also chose PARAPLEX resins for such products as heat-resistant lamp shades; smooth, one-piece trowels; and rugged camera cases. PARAPLEX was preferred because:

PARAPLEX "P" resins are available in a number of grades, each compatible with all the others. They can be blended to obtain special properties. The resins can be infinitely diluted with monomeric styrene and other monomers.

PARAPLEX "P" resins are 100-percent reactive. They can be converted into solid, infusible products which are soft and flexible, or rigid and tough.

PARAPLEX "P" resins can be cured at either room or elevated temperatures. By proper catalyst selection, they can be adapted to a variety of production schedules. The resins are highly stable, both when catalyzed and uncatalyzed.

PARAPLEX is a trade-mark Reg. U.S. Pat. Off. and in principal foreign countries.

By making their diaper hamper of PARAPLEX resins and glass fibers, Holiday Plastics gave it light weight, high strength, and long life. The hamper won't dent. Colors won't come off even under the frequent steam-sterilization to which these hampers are subjected, because the colors go through and through. Cleaning is easy. The resins are unaffected by soap and water, common solvents, and many corrosive liquids.

Sound interesting? Then write us today and let us tell you more about the PARAPLEX resins.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

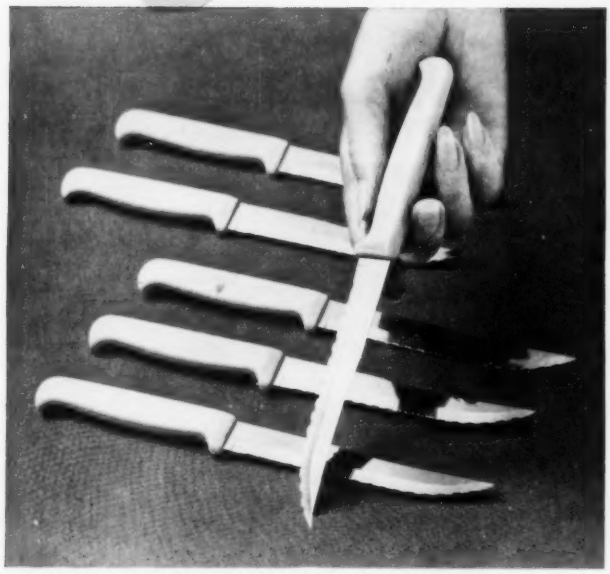
THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

hercocel®

FOR PREMIUMS THAT MOVE MERCHANDISE



Quikut cutlery, available in a wide assortment of gift items and sets, is manufactured by Quikut, Incorporated, Fremont, Ohio.

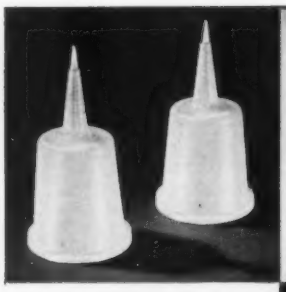
Quikut's high style line of quality premiums moves merchandise fast! The reason is obvious: a universally popular product with a value far beyond the premium's actual cost—thanks to versatile, durable Hercocel.

Combining highly polished stainless steel blades—hollow ground for razor sharpness, or serrated for instant cutting—with colorful Hercocel handles, Quikut steak knives are *premiums plus!* Available in glamorous "pearl" for that luxury look, or smoothly finished pistol grip handles in handsome solid colors, they complement the finest table setting.

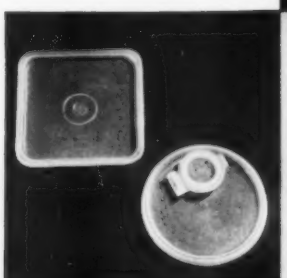
Smart merchandisers know that premium products made with Hercocel combine beauty, utility, and consumer appeal at modest unit cost. For your best premium buy, it's Hercocel—the low-cost, quality plastic.

Cellulose Products Department
HERCULES POWDER COMPANY
916 Market Street, Wilmington 99, Del.

CP54-9



NOBODY HAS AS MUCH EXPERIENCE AT MOLDING POLYETHYLENE AS TUPPER!



Tupper Seals are air and liquid-tight flexible covers. The famous Pour All and Por Top covers are designed for easy dispensing. They are made in sizes to fit all Tupperware containers.

When equipped with Tupper Seals, Tupper Canisters, Sauce Dishes, Wonder Bowls, Cereal Bowls and Funnels in various sizes are the most versatile reusable containers you have ever seen.

The logical molder for you to consult regarding that product or package of yours which is to be made of polyethylene is Tupper. Tupper has done more than any other molder to make molded polyethylene a practical reality.

Aside from having designed, patented, and promoted successful seals, closures, and dispensers for polyethylene containers, the Tupper Corporation has vast experience in *every phase* of polyethylene packaging and polyethylene injection molding. This experience will be of major importance in improving your product, in reducing your costs, when Tupper goes to work for you.

Tupper's combination of experience, technical ingenuity, and the most modern equipment is at your service for the custom molding of your product in polyethylene. You can do no better than the best ... and the best at molding polyethylene is Tupper!

TUPPER! TRADE MARK

TUPPER PRODUCTS ARE FULLY PROTECTED

About 150 United States and foreign patents and patents applied for, plus numerous trademarks and copyrights, cover the design and manufacture of the various types of Tupper Seals and other Tupper Products. Unauthorized manufacture of items covered by Tupper patents will subject infringers to prosecution.

TUPPER CORPORATION

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

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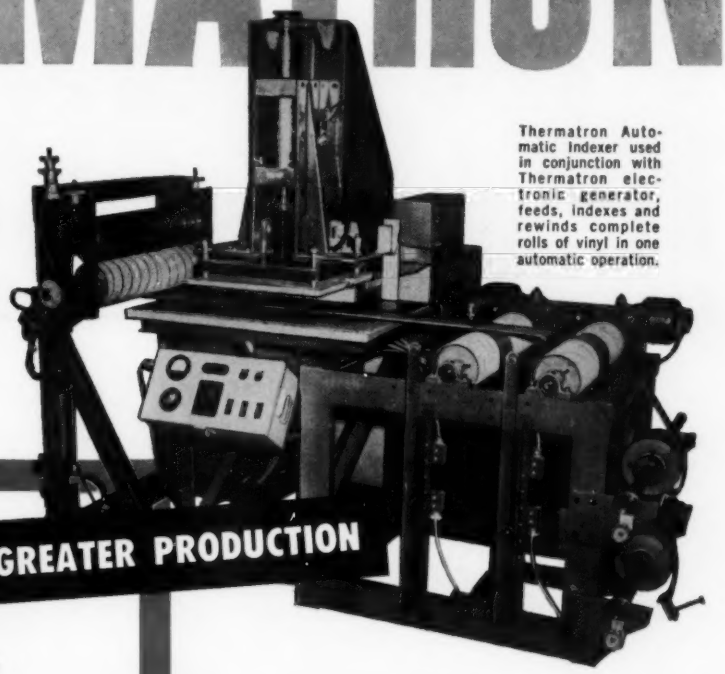
Showrooms: 225 Fifth Ave., N. Y. C.
Address All Communications To: Dept. M-12

THERMATRON

Here's a simple equation for more profitable welding of vinyl plastic...



Thermatron Automatic Indexer used in conjunction with Thermatron electronic generator, feeds, indexes and rewinds complete rolls of vinyl in one automatic operation.

LARGER EQUIPMENT = GREATER PRODUCTION

...at far less cost!

Large Thermatron P16 Press and automatic turntable used in conjunction with Thermatron electronic generator, can be adjusted for up to 24 indexes per revolution.

Today's stepped up competition calls for a review of your production methods with emphasis on speed, economy and "automation." THERMATRON equipment for electronic welding of vinyl answers this challenge with *larger*, automatic machines that slash costs and increase output . . . on both small and large products!

With the same labor, the same cutting and the same handling you now employ, large THERMATRON units such as the P16 Press, Automatic Turntable and Automatic Indexer permit ganging up production runs. The job is done quicker, cost is far lower and the resultant savings are sure to pay for the equipment in no time at all.

Why make do with smaller plastic sealing equipment when larger THERMATRON electronic generators and presses can make yours an *automatic* operation. Write today for complete details on our trade-in offer—and our comprehensive bulletin No. 90.

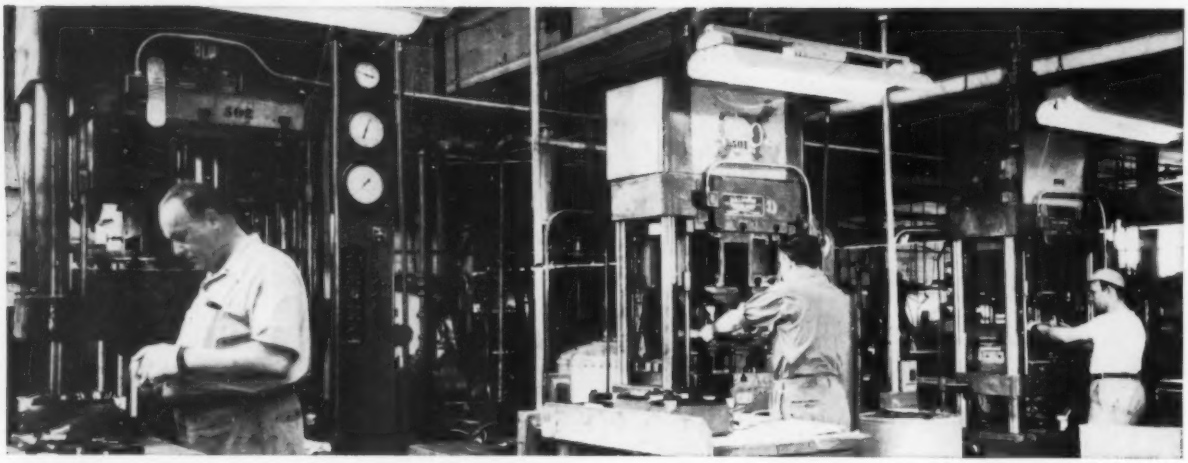
Thermatron Division

RADIO RECEPTOR COMPANY, INC.

Thermatron

In Radio and Electronics Since 1922

SALES OFFICES: 251 West 19th St., New York 11, N.Y. WAtkins 4-3633
Chicago: 2753 West North Ave.
Los Angeles: Electroseal Plastics Co., 130 North Juanita Ave.
Factories in Brooklyn, N.Y.



Tech Art Plastics Company reports:

"Our Baldwin Presses up production 25%!"

Over half a century of experience adds extra significance to Tech Art Plastics Company's appraisal of its equipment. Mr. J. Hormick, Tech Art's Molding Superintendent, has this to say about the Baldwin presses they use to produce a wide variety of impact plastics for radios, appliances and other electronic equipment:

"We've gotten 25% more production from our Baldwin presses than from any other similar equipment in the plant. The units meet every high-speed production need.

"Both top plunger and molding clamping characteristics can be easily controlled and adjusted. So, with proper molding technique, these presses mold close tolerance precision parts with a minimum of flash, saving us considerable finishing time.

"These versatile Baldwin presses handle compression molding jobs and plunger molding work with equal ease and efficiency."

Molding, pre-forming or laminating plastics . . . whatever your pressing problem, you can count on Baldwin to help you solve it. Please contact your B-L-H representative or write for the latest bulletins with complete data on Baldwin presses for the Plastics Industry. Address: Department 4826, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pennsylvania.

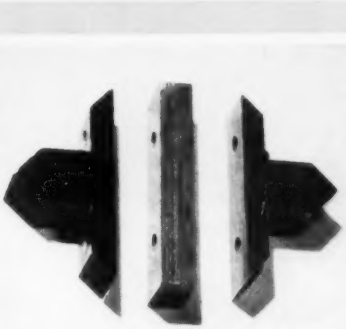
BALDWIN BLH LIMA-HAMILTON

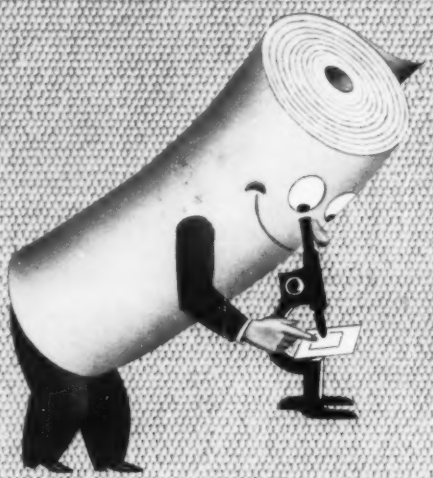
BALDWIN-LIMA-HAMILTON

Philadelphia 42, Pa. • Offices in Principal Cities

UNIFORMITY

Makes The Big Difference In LAMINATION FABRICS





MT. VERNON EXTRA

Gives You Greater Fabric Uniformity

FABRICS ENGINEERED TO FIT YOUR NEEDS – Need adaptation of an existing fabric to your special purposes? Or creation of an entirely NEW fabric – cotton, synthetic or blend – to meet your specifications? Mt. Vernon-Woodberry's staff of textile engineers is available on request to help you with your problems in development or application of industrial fabrics.

Mt. Vernon-Woodberry Mills

TURNER HALSEY COMPANY
Selling Agents

Main Office: 40 Worth St. • New York

Branch Offices: Chicago • Atlanta • Baltimore • Boston • Los Angeles

One of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products. Here fabric thickness after weaving is being gauged.

Spencer Service is Wonderful

"You'd better take these, Tanky, they're rush orders!"

You'll start seeing this man shortly. He is the salesman for Poly-Eth, Spencer's brand of polyethylene, the new wonder plastic. Your Poly-Eth salesman is technically trained to discuss your problems and be ready to give you top service when Poly-Eth goes into production at Spencer's new polyethylene plant. Look for him.

We know that when you order raw materials you want them delivered *on time*. That's why we specialize in making *on time* deliveries of Spencer Formaldehyde. Why not let us prove what this Spencer service can mean to you? A phone call is all it takes.

SPENCER

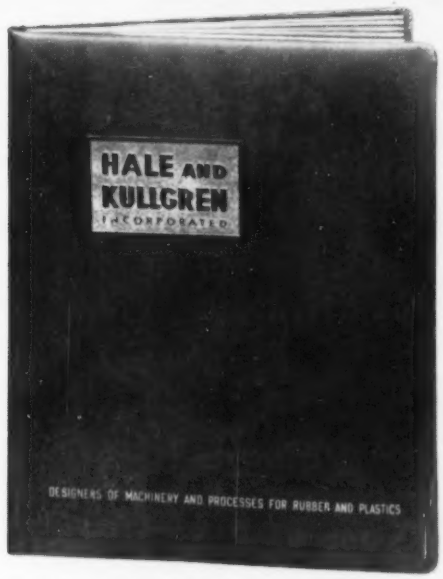
America's Growing Name In Chemicals

SPENCER PRODUCTS: "Mr. N" Ammonium Nitrate Fertilizer • SPENSOL (Spencer Nitrogen Solutions) • Ammonia (Commercial and Refrigeration Grade) Aqua Ammonia • 83% Ammonium Nitrate Solution • Synthetic Methanol Formaldehyde • Hexamine • Polyethylene (1955) • FREZALL (Spencer Dry Ice) • Cylinder Ammonia

SPENCER CHEMICAL COMPANY

General Offices, Dwight Bldg., Kansas City, Mo. Works: Chicago, Ill., Pittsburg, Kan., Henderson, Ky., Vicksburg, Miss., and Orange, Texas (under construction.)

if you want to **lower** your manufacturing **costs**

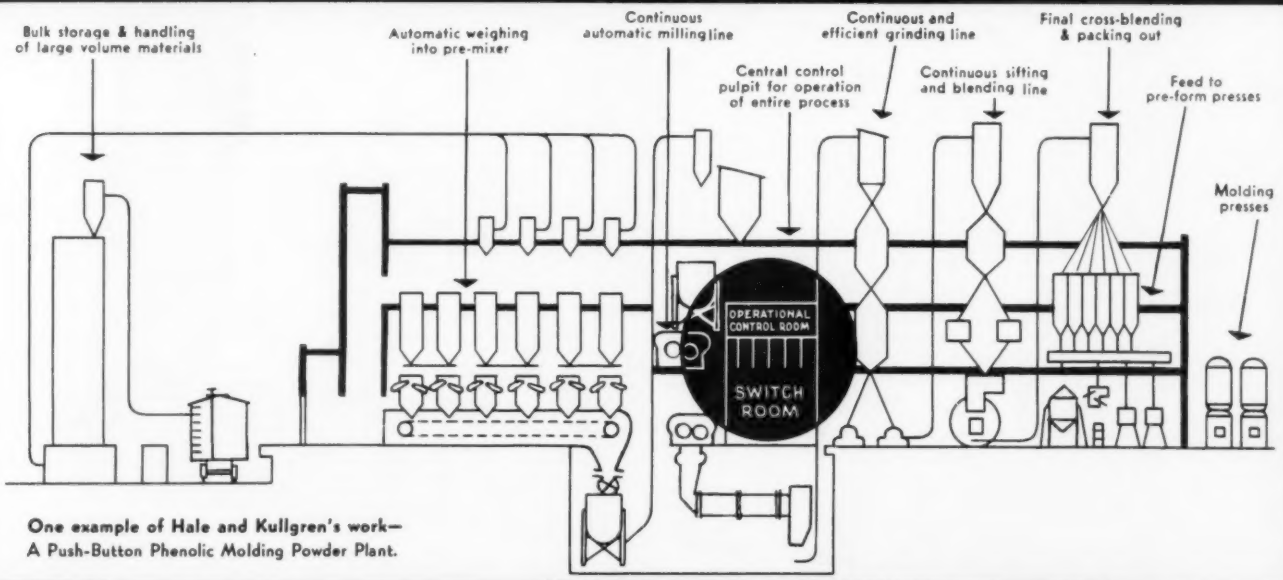


Cost of a preliminary study for you is low.

If you can improve your conversion and material costs, your profit picture will benefit.

Maybe you can and maybe you can't, but Hale and Kullgren can guide you. Hale and Kullgren's experience can be of invaluable help in applying the principles of automation to accomplish cost reduction in your plant.

For example, here is what Hale and Kullgren will answer in a study of your plant, or plants, or department: Proposed ultimate production schedule; plant layout — present and future; description of proposed processes, including direct and indirect labor requirements; detailed description and cost of plant modifications and new equipment; projected manufacturing costs based on modernized plant and processes; appendix of supporting data. The cost of a study is low.



One example of Hale and Kullgren's work—
A Push-Button Phenolic Molding Powder Plant.

your inquiry

Hale and Kullgren offers a complete service to anyone making or processing rubber or plastics. They can engineer and build a complete plant, develop a specialized process and design special equipment. They are specialists in automation as applied to the rubber and plastics industry. You will be interested in your own study, plus examples of what they have done for others.

CONSULTANTS FOR RUBBER AND PLASTICS

HALE AND KULLGREN INCORPORATED

associated with The Aetna-Standard Engineering Co.

The Purchasing Agent

You can watch your mold run at—

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE—CHANIN BUILDING, 122 EAST 42ND STREET, OXFORD 7-0155

Our photograph shows the Vickers-Armstrong 'Viscount', one of the latest British aircraft which has been ordered by leading airline Companies in North America, Australia and other countries throughout the world.

'PERSPEX' on top

'Perspex' is the acrylic sheet specified for British civil and military aircraft supplied to the R.A.F., Commonwealth and N.A.T.O. Air Forces, and to international airline operators. It has withstood the test of time in aircraft operating at all heights in all parts of the world and this proven material is now naturally preferred for the latest forms of air transport. Clear 'Perspex' acrylic sheet is used for windows and the opal and coloured grades are used for lighting fittings, window framings, panelling and other decorative fitments.

'Perspex' is the registered trade mark for the acrylic sheet manufactured by I.C.I.

IMPERIAL CHEMICAL INDUSTRIES LTD., PLASTICS DIVISION, BLACK FAN ROAD, WELWYN GARDEN CITY, HERTS, ENGLAND.

U.S.A. ENQUIRIES TO: J. B. HENRIQUES INC., 521 FIFTH AVENUE, NEW YORK 17, N.Y.

ICI

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How to Lower Vinyl Compounding Costs

Chlorowax* 40 and Surfex* MM can be used separately or in combination to lower vinyl compounding costs and increase batch yields with no sacrifice in quality. Chlorowax 40 is DIAMOND ALKALI's liquid chlorinated paraffin which has gained wide acceptance as a low-cost co-plasticizer. Surfex MM is one of DIAMOND's precipitated calcium carbonates—a filler of high uniformity and purity.

The table below shows how these DIAMOND Chemical products can be used to produce two-way savings. Your nearby DIAMOND Sales Office can show you other moneysaving formulas and supply detailed cost comparisons, or write DIAMOND ALKALI Co., 300 Union Commerce Building, Cleveland 14, Ohio. **

DIAMOND SALES OFFICES:
New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Houston.

DIAMOND DISTRIBUTORS:
C. L. Duncan Co., San Francisco and Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U.S.A.; Harrisons & Crosfield (Canada) Ltd.

TRY THIS RECIPE FOR LOWER COST VINYL COMPOUNDS

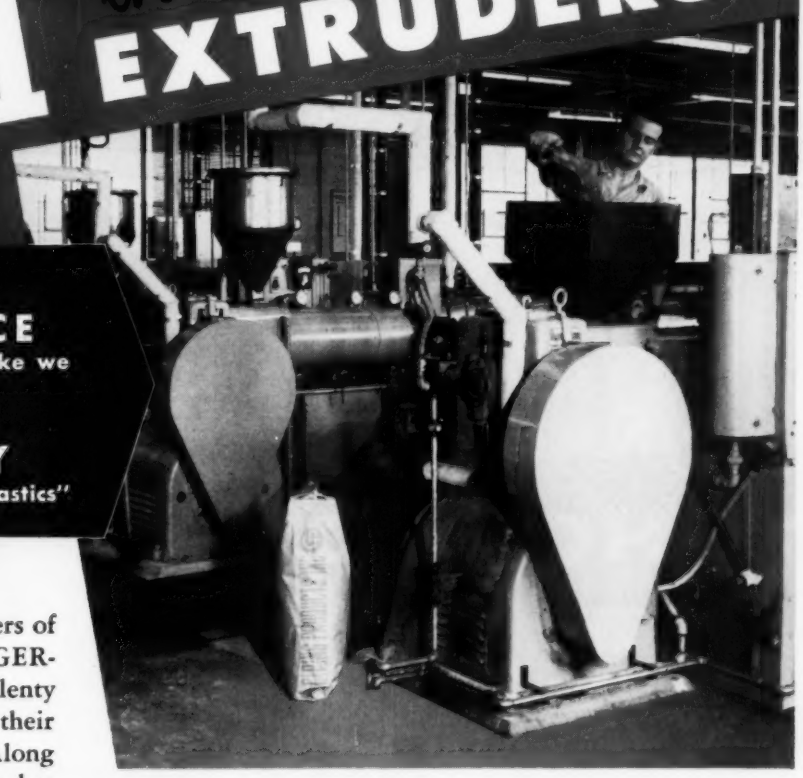
	Parts
PVC Resin	100
Primary Plasticizer	50
Chlorowax 40	10
Stabilizer	3
Stabilizer-Lubricant	0.5
Surfex MM	20
	183.5
Hardness	85A
Tensile Strength	2600 psi
Elongation	375%
100% Modulus	1400 psi
Crescent Tear	375 lbs./in.
Brittleness-Temperature	-29°C
Heat Loss	4.7%

DIAMOND ALKALI CHEMICALS®

DIAMOND ALKALI COMPANY
CLEVELAND 14, OHIO

Here's what GERING PRODUCTS, INC., think of their

NRM thermoplastic EXTRUDERS



"LESS MAINTENANCE
compared with any other make we use, and
GREATER VERSATILITY
in the extruding of all thermoplastics"

GERING PRODUCTS, INC., makers of GER-PAK, GER-FLEX and GER-TUBE extruded plastics, have plenty of experience upon which to base their opinion of NRM Extruders. Along with extruders of several other makes in their large new Kenilworth, N. J., plant, they operate six NRM's, producing film sheet, tubing and custom profiles.

When we asked Gering Products, Inc., about their experience with NRM Extruders, we were not surprised at their spontaneous reply: "Less maintenance . . . greater versatility." NRM Extruders are *ruggedly* built, with corrosion-resistant cylinders and screws. We *know* they will require "less maintenance" through a long, highly productive life. We know, too, that NRM's patented screw designs, balanced heat control and quick-opening die gates also work to the *profitable* advantage of any NRM owner, in high output of top quality extrusions from *all* thermoplastics.

WRITE FOR FACTS AND DATA ON THE NRM FULL LINE OF PLASTICS EXTRUDERS AND EQUIPMENT

Today

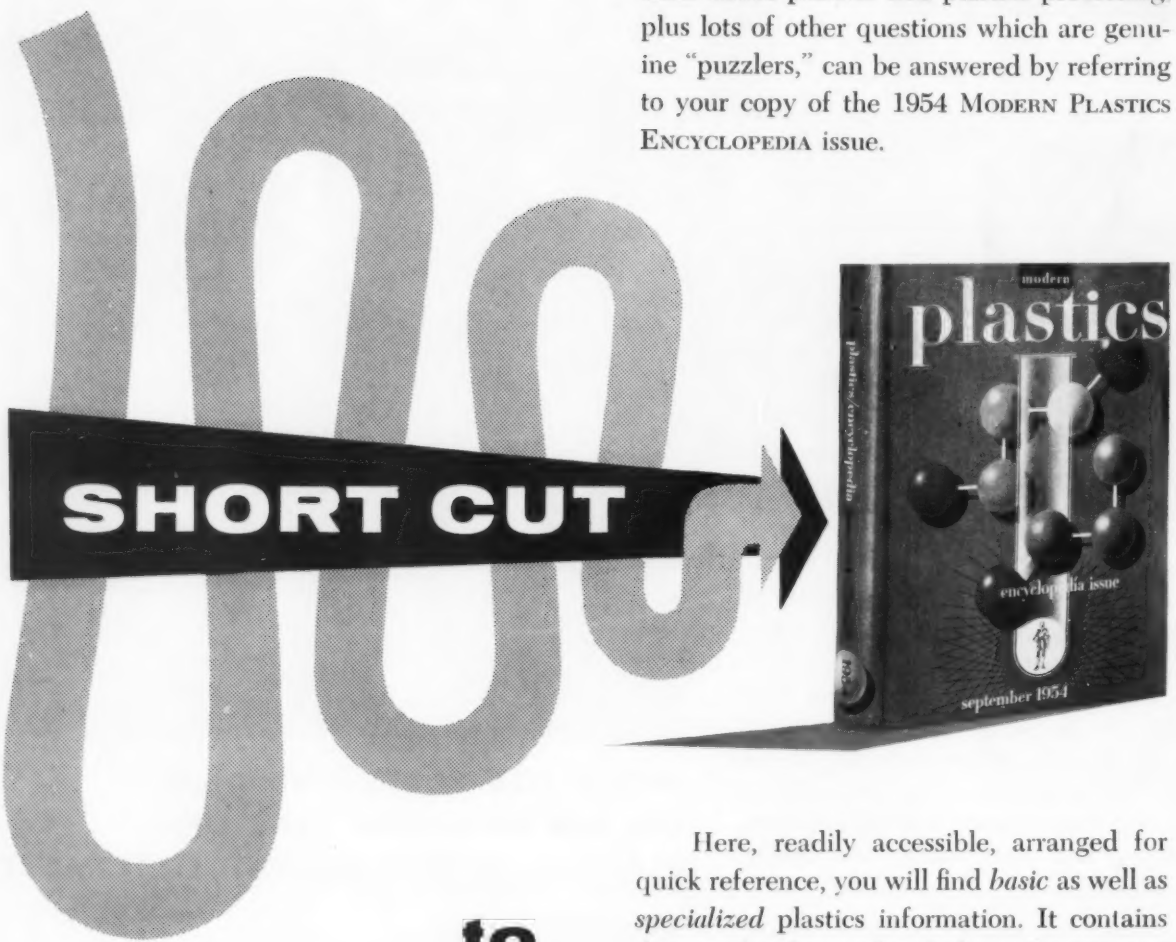
Read why plastics producers the world over prefer NRM for most profitable extrusions . . . and make your next extruder an NRM.

NATIONAL RUBBER MACHINERY CO.

East: 384 Getty Ave., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Calif.
Export: Omni Products Corporation, 460 Fourth Ave., New York 16, N. Y.

2325

A high proportion of your routine questions about plastics and plastics processing, plus lots of other questions which are genuine "puzzlers," can be answered by referring to your copy of the 1954 MODERN PLASTICS ENCYCLOPEDIA issue.



to plastics information

Here, readily accessible, arranged for quick reference, you will find *basic* as well as *specialized* plastics information. It contains data on the chemical and physical properties of the different plastics resins . . . on processing film and sheeting . . . on decorating plastics . . . on laminating . . . on mold design for various types of molding . . . on machinery and equipment . . . on literally *thousands* of additional subjects.

Get acquainted with the MODERN PLASTICS ENCYCLOPEDIA issue right away. Refer to the many fact-filled ads. Explore the extensive Directory Section which lists suppliers of materials, equipment and services. Use it often.

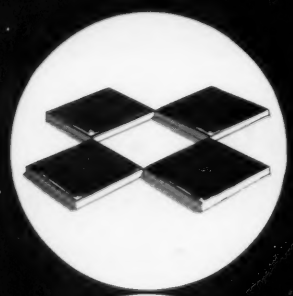
MODERN PLASTICS

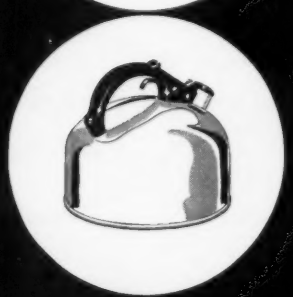
575 Madison Avenue, New York 22, N. Y.

Give your products the *Smart Black Look*

WITH WITCO-CONTINENTAL

CARBON BLACKS





Nothing matches black for smartness and practicability . . . whether it's floor tile, furniture upholstery, handles for pots and pans . . . or any one of a hundred other uses. And to make sure the black you use meets the requirements of your product, specify one of Witco-Continental's carbon blacks for pigmenting.

Witco-Continental channel and furnace blacks are made in 5 modern plants under rigid quality control to give you tops in dependable performance. They've been noted for their uniformly high quality for nearly 30 years.

WITCOBLAK® No. 11—low color channel
WITCOBLAK No. 32—maximum jetness at low cost
WITCOBLAK No. 50—good color and tinting strength
WITCOBLAK No. 100—jetter color, Nigrometer 74
WITCOBLAK HITONE—jet black, Nigrometer 71

and . . . to meet your other plastics requirements . . .

Witco offers a complete line of:

METALLIC STEARATES
STAYRITE* (Stabilizers)
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WITCARB® (Precipitated Calcium Carbonate)

Write for complete technical data or laboratory samples. *Witco-Continental* Technical Service will be glad to assist you with your problems. *Trade-mark

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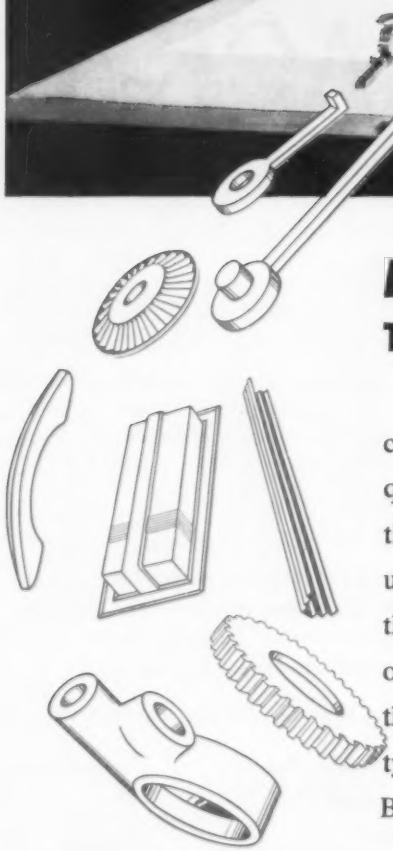


ENGINEERING . . .

The Basis of QUINN-BERRY Service

When you consult Quinn-Berry for molded plastics, a competent, experienced engineering staff tackles your requirements right in the planning or blueprint stage. From that point to the finished product, your molded plastics are under the supervision of these Q-B engineers every step of the way. And these steps include precision mold-building in our own machine shops by some of the finest craftsmen in the country, skilled production on modern presses, and any type of finishing required. Thus, in molded plastics, Quinn-Berry offers a complete service with undivided responsibility.

DETROIT, Mich. Harry R. Brethen, 15 Lawrence, *Townsend 8-2577*

ARDMORE, Pa. Austin L. Wright, P.O. Box 561, *Hilltop 7-0345*

MILWAUKEE, 13, Wisc. John Weiland, Jr., 7105 Grand Parkway, *Greenfield 6-7161*

EAST ROCHESTER, N.Y. Harwood Molded Products, Fairport Road 941

BRONXVILLE 8, N.Y. Edwin S. Dunbar, Jr., 64 Kensington Road, *Deerfield 7-7709*

DAYTON 9, Ohio G. R. Vines, 637 Monteray Avenue, *Walnut 5174*

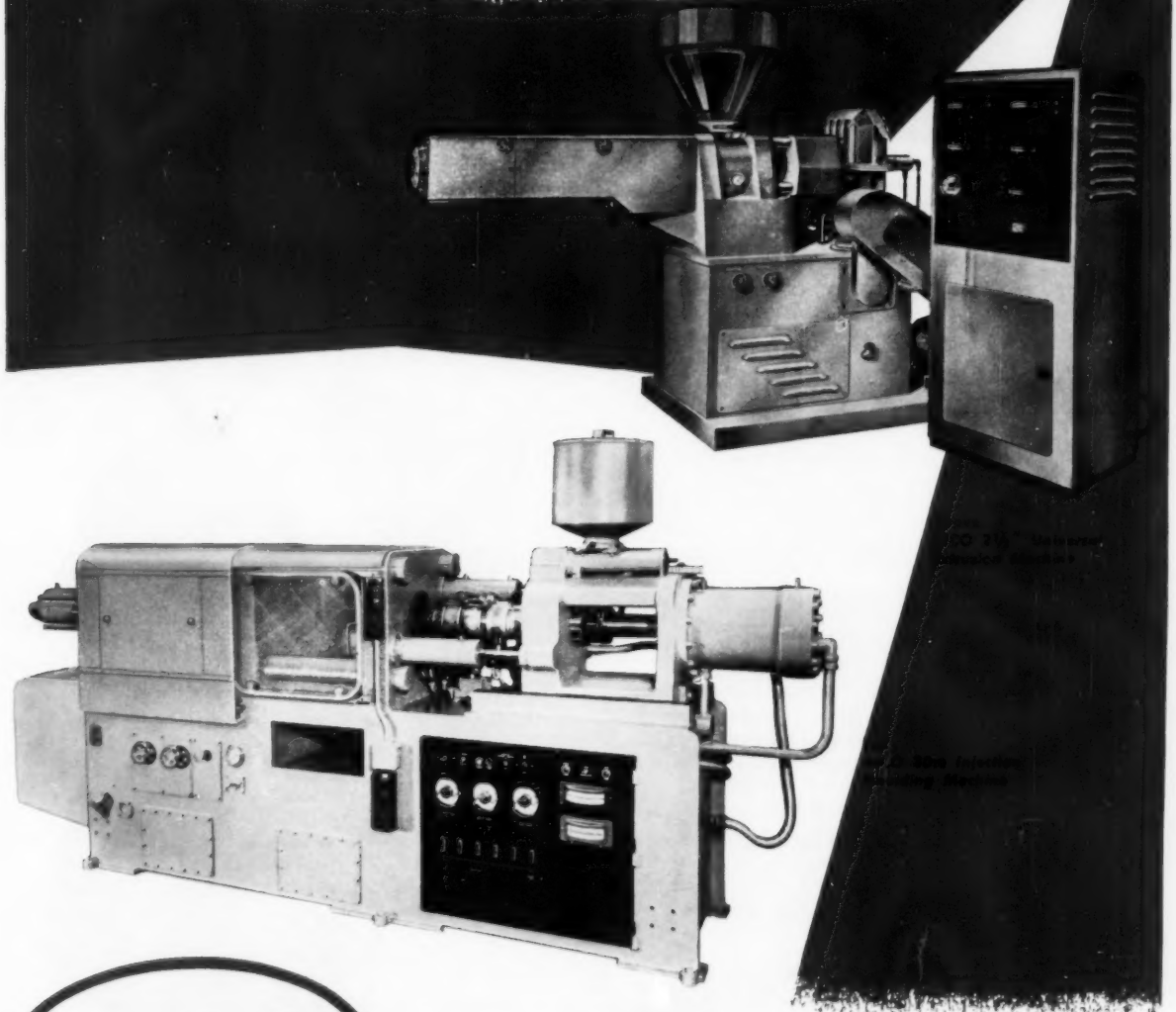
QUINN-BERRY CORP.

PLASTICS

2651 WEST 12th STREET, ERIE, PENNA.

MOLDERS OF ALL TYPES OF THERMOPLASTIC MATERIALS

INJECTED or EXTRUDED



PECO MAKE THE MACHINES -THAT DO THE JOB

Peco Injection Moulding Machinery is now well established throughout the world as equipment in which the best engineering skill and experience are combined with the latest developments in plastic technology.

A recent addition to the PECO range of machines for the plastics industry is the 2½" Universal Extrusion Machine which is illustrated above. This machine aroused much interest at the 1953 Plastics Exhibition in London.

Illustrated literature is available on all PECO products and will be gladly sent on request.

PECO PRODUCTS

PECO MACHINERY SALES (Westminster) LTD.

28, VICTORIA STREET : : LONDON, S.W.I. : : ENGLAND

Telephone: ABBey 1793/4/5 Telegrams: PROFECTUS, SOWEST LONDON Cables: PROFECTUS LONDON

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THE PROJECTILE & ENGINEERING COMPANY LTD ACRE STREET, LONDON, S.W.8

New Wellington Sears spun rayon fabrics give a smooth, good-looking finished surface and improved tear strength to upholstery and other coated products.

"Columbus" cotton sheeting is widely used for coatings demanding high quality, flexibility, easy handling, and an absolute minimum of production rejects.

YOU GET STYLING PLUS DURABILITY WITH WELLINGTON SEARS "LANTUCK"

A "natural" for deeply embossed patterns, Lantuck non-woven fabric has been specially developed by Wellington Sears for vinyl coating. Its random fibers are bonded with a specifically selected heat-sensitive resin which affords complete fusion with vinyl for easy molding and shape retention.

In addition to embossability, Lantuck features true multi-directional strength because of its completely random distribution of fibers.

Lantuck may be calender coated, laminated or electronically sealed to vinyl film. Highly flexible, it provides smooth surface and high gauge-weight ratio at reasonable cost. Stitch and tear strength is improved without interfering with the vinyl film's soft, pliable hand, so important in upholstery, auto seat covers and the like.

Lantuck for coating is available in 54 to 56 inch width in weights of about 3 to 4 ounces per square yard. For further facts—including development work now in process—contact our nearest sales office.

Write for a free copy of "Modern Textiles for Industry" which includes pertinent information on fabric-and-plastic applications. Address: Wellington Sears, Dept. 1041, 65 Worth Street, New York 13, N. Y.

Superior Fabrics for Coating and Laminating

- Single filling ducks
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- Single and plied-yarn chafers
- Special ducks
- Sateens
- Twills
- Broken twills
- Drills
- Sheetings
- Nylon, rayon, Orlon* and other synthetics
- Lantuck non-woven fabrics

*DuPont's trademark for its acrylic fiber

Wellington Sears

A SUBSIDIARY OF WEST POINT MANUFACTURING COMPANY

FIRST In Fabrics For Industry

WELLINGTON SEARS COMPANY, 65 WORTH STREET, NEW YORK 13, N. Y.

Offices In: Atlanta • Boston • Chicago • Detroit • Los Angeles • New Orleans • Philadelphia • San Francisco • St. Louis

NEW TRANSPARENT PLASTIC COLORS WITH PEROX DYES

Stable to organic peroxides catalysts—heat—and light.

Soluble in polystyrene—polyester—vinyl—and epoxy resins.

Bright Transparent Shades or Brilliant Pastels when combined with white substrate pigments.

Blue Whitener to correst excessive yellowness of resins.

Product samples and plastic color chips are available from

PATENT CHEMICALS, INC.

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FULL COLOR DEVELOPMENT WITH SOTEX DISPERSING AGENTS

Preblend polystyrene with Sotex 3CW when dry blending with dyestuffs and pigments.

Preblend vinyl polymers and co-polymers with Sotex CW to obtain complete dispersion in calendered film formulations.

Sotex CW for viscosity control and dispersion in vinyl plastisols and organisols.

Samples and complete information available from

SYNTHETIC CHEMICALS, INC

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Before You Buy Any...

Plastic Molding Machine

be sure to see the New Improved
High Speed • Fully Automatic

MOSLO Model 73

FOR
PERFORMANCE
CAPACITY
DEPENDABILITY
SIMPLICITY
SAFETY
APPEARANCE

SEE THE NEW RE-DESIGNED MOSLO LINE
—FULLY AUTOMATIC FOR ALL REQUIREMENTS

Before you buy any plastic molding machine, either fully automatic or hand operated, we urge you to investigate the features of the MOSLO line. These are the machines that are setting new and higher standard of quality production for many types of molding operations. They have the effective controls, rugged construction, reliability and speed that make profitable production possible, year after year, in all lines of the plastic molding industry. Savings extend to materials and mold cost as well as productive time.

Hydraulic Manifold

The "Heart" of a Moslo Machine

All hydraulic valves are mounted on a convenient hydraulic manifold. This manifold eliminates 60% of the pipe fittings normally installed in an injection molding machine. It simplifies maintenance problems and eliminates many potential oil leaks.

MODEL 73
- 2 oz. injection capacity per shot
- 1200 cycles per hour
- 25 lbs. per hr. *plus* plasticizing capacity
- Molds 20 square inches of area *plus*
- Material hopper capacity—40 lbs.
- Mold opening 6"

MODEL 75
- 2-3 oz. injection capacity per shot
- 740 cycles per hour
- 50 lbs. per hr. plasticizing capacity
- Molds 40 square in. of area
- 50 lbs. capacity of material hopper

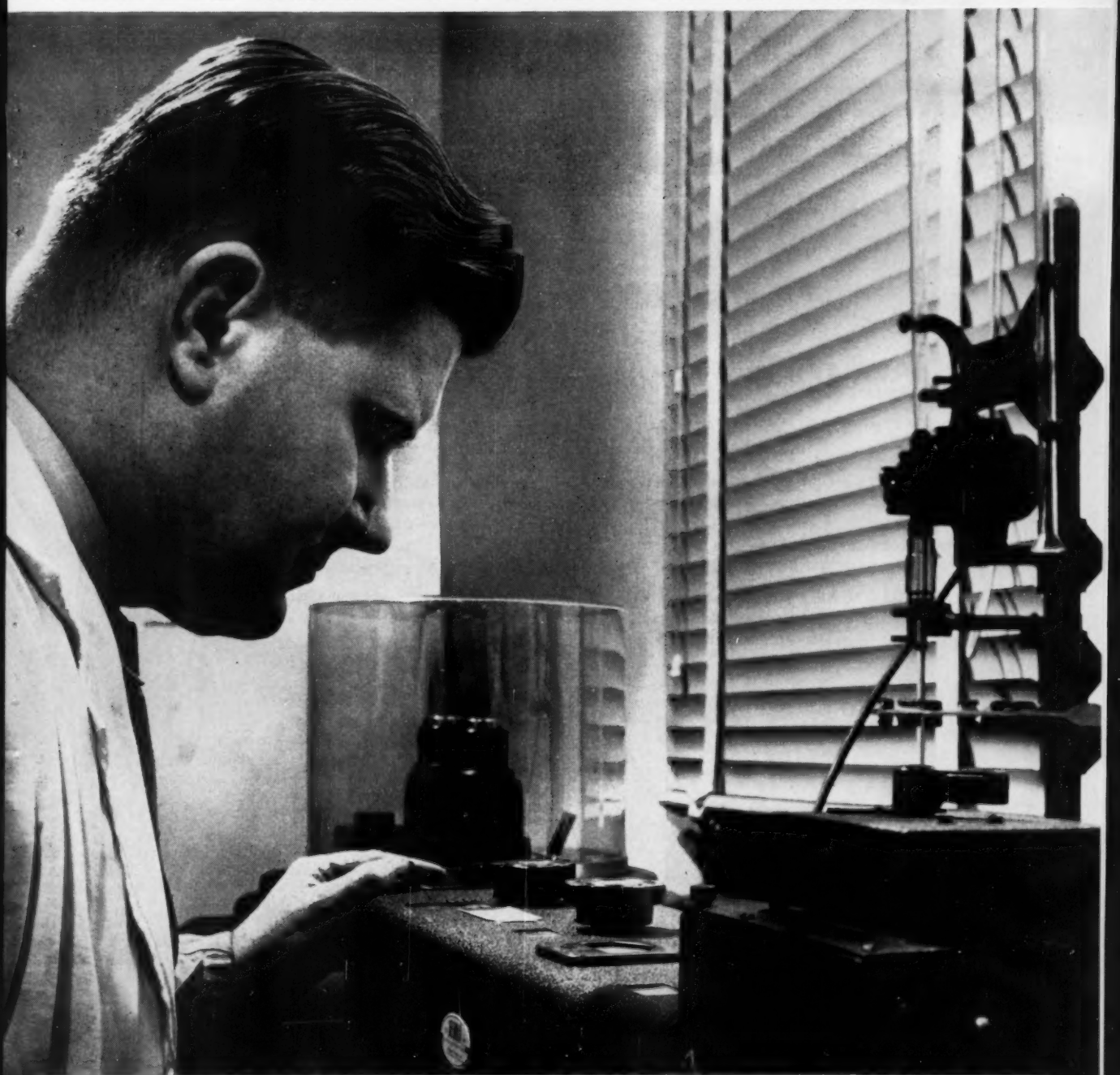
This machine is available with mold arrangement and cycle to fit requirements of mold opening from 8 to 16 inches.

MODEL 80
- 3-4 oz. injection capacity per shot
- 780 cycles per hour (dry run)
- 75 lbs. per hr. plasticizing capacity
- Molds 60 sq. inches of area
- 60 lbs. capacity of material hopper
- Mold opening 8"

Write, wire or call to arrange a demonstration. We have a Model 73 set up for a working demonstration at your convenience.

MOSLO MACHINERY COMPANY

2443 PROSPECT AVENUE • CLEVELAND 15, OHIO



This color "fingerprinter" can't be fooled!

Production samples of Glidden chemical compounds must pass the rigid "fingerprint" test of the Spectrophotometer. Each compound has its own absorption spectra which must match the master sample. This method of testing is the most accurate known for color consistency and particle uniformity.

This exacting test is one of many in the Glidden Quality Control program that assures you of the finest pigment available, whether it be ZOPAQUE Titanium Dioxides; CADMOLITH Reds and Yellows; or SUNOLITH Lithopones. Write now for detailed information.

THE GLIDDEN COMPANY

Chemicals • Pigments • Metals Division

Baltimore, Maryland • Collinsville, Illinois • Hammond, Indiana • Scranton, Pa.

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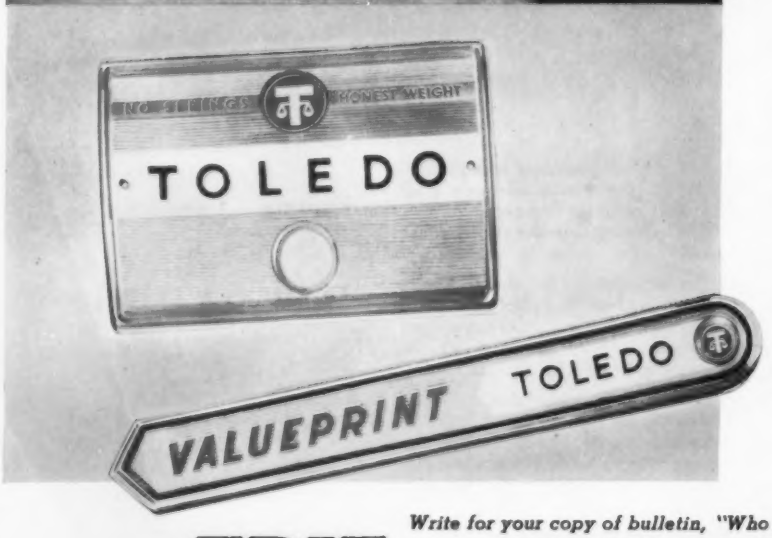
PIGMENTS
METALS

QUALITY
Glidden

AN *Honest Weigh* TO ATTRACT CUSTOMERS . . .



with three dimensional *plastics* by

ERIE

Custom Molded Plastics

Toledo Scale Company frames the "customer's window" on their new Guardian "70" Duplex Scale and also identifies their new Valueprint Prepackaging Scale with a beautiful three dimensional plastic plate in crystal, white, silver, and red — an eye-compelling magnet that enhances the beauty of these modern food store machines.

ERIE is helping hundreds of manufacturers to add sales appeal to their products with functional parts that combine gleaming beauty with utility; and with sparkling three dimensional trademarks and name plates that make the company's identification an outstanding symbol of quality that stimulates the owner's pride of possession.

ERIE has complete facilities for the execution of your order, from mold design to precision molding, foiling, spraying, drilling and packaging.

Write for your copy of bulletin, "Who We Are . . . What We Do in Plastics."

ERIE RESISTOR CORPORATION . . . PLASTICS DIVISION

ERIE RESISTOR CORP. TRADE MARK

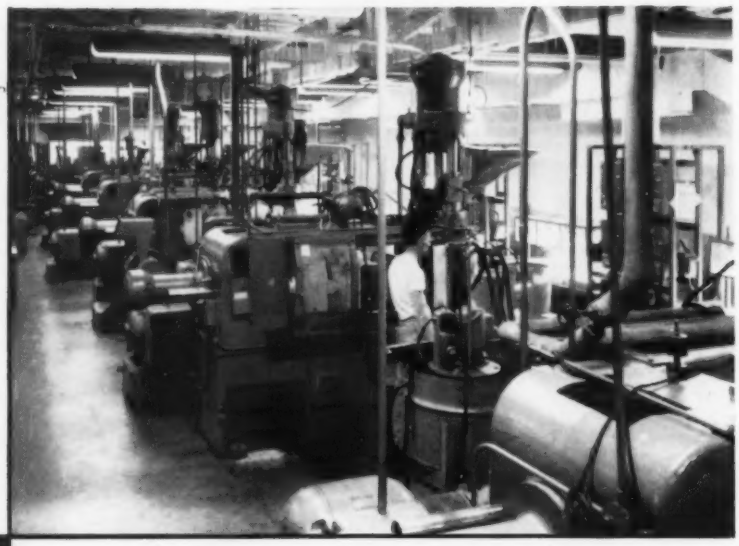
Main Offices and Factories: **ERIE, PA.**

Sales Offices: Cliffside, N. J. • Camden, N. J. • Chicago, Ill. • Detroit, Mich. Cincinnati, Ohio • Fort Wayne, Ind. • Los Angeles, Calif. • Toronto, Ontario

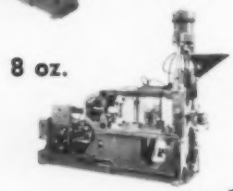
Manufacturing Subsidiaries:

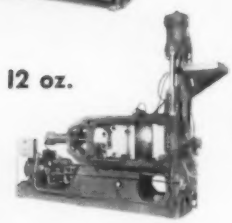
HOLLY SPRINGS, MISSISSIPPI • LONDON, ENGLAND • TRENTON, ONTARIO

W. A. Sheaffer Pen Co.



USES ONLY... LESTER MACHINES...





The modern fountain pen is a surprisingly precise and carefully assembled instrument. The mass-produced components must conform to rigid tolerances. This applies equally to the plastic parts, which must *also* undergo rigorous inspection for quality of finish.

In the modern, well-lighted, humidity-controlled, air-conditioned molding department of the Sheaffer Pen Company's new $3,500,000 plant at Ft. Madison, Iowa, plastic parts for Sheaffer pens and pencils are molded on the Lester 8 oz. Injection Molding Machines shown in the photograph above. The company also has 12 oz. and 4 oz. Lester Machines not shown in this photo. Sheaffer depends entirely on the Lesters for quality molding of the hundreds of thousands of plastic parts they produce yearly.

If you are interested in complete specifications on Lester Injection Molding Machines, we will be happy to send them to you. While you are at it, ask to be placed on the mailing list for the Lester-Phoenix house organ the Lester Press.

LESTER INJECTION MOLDING MACHINES

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for superior light fastness and flushability

HELIOGEN® PRESSCAKES

phthalocyanine blues and greens of exceptional brilliance and workability

Clear, clean, brilliant HELIOGEN Colors are the finest nonfading blues and greens available today... always in demand where quality comes first.

Heliogen Blue BDV Presscake	Heliogen Blue BNC Presscake Special	Heliogen Blue BG Presscake Special	Heliogen Green GB Presscake Special
Dark, transparent mass tones	Stable dimensionally	Peacock blue shade	Bluer shade, with added strength
Crystallizing type	Noncrystallizing	Noncrystallizing	Noncrystallizing
No surfactants	No surfactants	No surfactants	No surfactants
Nonbleeding	Slight bleeding	Nonbleeding Heat resistant	Nonbleeding
24% dry content (approx.)	25% dry content (approx.)	40% dry content (approx.)	29% dry content (approx.)
FOR FLUSHING IN:			
Oil base paints Plastics Printing inks Varnishes Textile printing	Plastics Printing inks Varnishes Textile printing Rubber base paints	Oil base paints Plastics Printing inks Varnishes Textile printing Rubber base paints Baking enamels Enamels	Oil base paints Plastics Printing inks Varnishes Textile printing Rubber base paints Baking enamels Enamels

For more complete information on HELIOGEN colors, send for our handsome free booklet.

From Research to Reality

gdc gaf

GENERAL DYESTUFF COMPANY

A SALES DIVISION OF GENERAL ANILINE & FILM CORPORATION

435 HUDSON STREET • NEW YORK 14, NEW YORK

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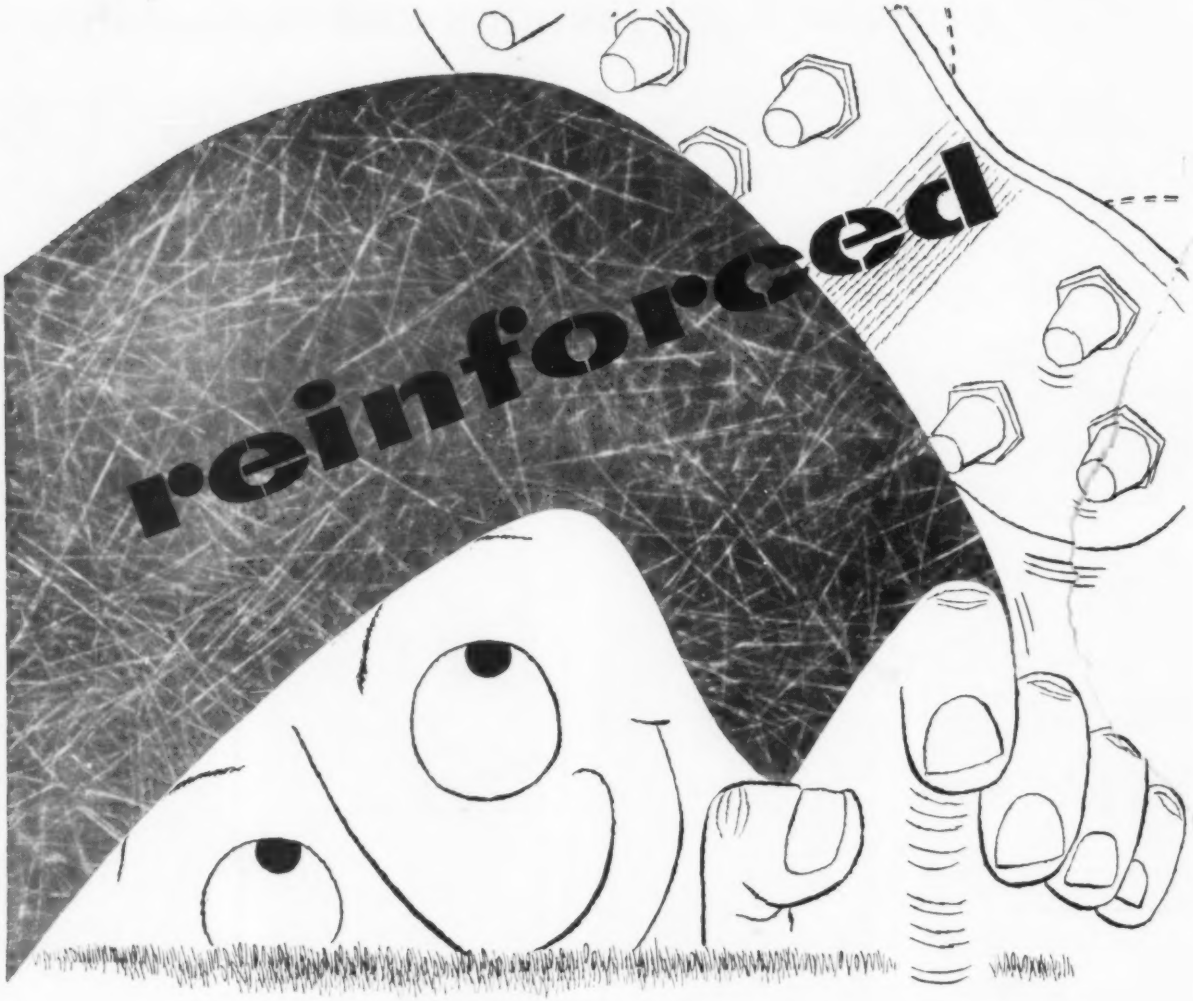

SUNFORM

Preimpregnated Glass Mat

The manufacturers of SUNFORM glass cloth announce the development of a superior glass mat, preimpregnated with polyester resin and catalyst. This product has exceptional uniformity, rigidly maintained by constant laboratory and production controls. Write for new data sheet and prices today. Address Dept. E9-1243.

A Division of Sun *Chemical Corporation*

Electro-Technical Products

Nutley 10, N. J.

Over 8 pounds of polyethylene are used in molding this 36-in. diameter water meter propeller for the Sparling Main-Line Meter, made by Sparling Meter Company.

METASAP® STEARATES

deliver easier mold release

For molding those intricate shapes, for deep drawing, or for larger-than-average pieces, the tested way to easy ejection is to use the right Metasap Stearate in your molding compound.

There are two ways to use these Stearates. You can incorporate Metasap Zinc or Calcium Stearates into the molding compound itself, or simply dust them on the molding surface. Either way, you get improved lubrication at lower ejection pressures. You step up your output, get fewer rejects, and better finished products. Your molds last longer too.

Metasap Technical Service is prepared to help you find the materials and mixing procedures best fitted to your production methods.

And to produce economical plastigels . . . Metasap offers a complete line of quality stearates, effective as thickening agents. Free testing samples of Magnesium, Barium, Calcium, or Aluminum Stearates are yours on request.

METASAP CHEMICAL COMPANY
Harrison, N. J.

REG. U. S. PAT. OFF.
METASAP CHEMICAL COMPANY

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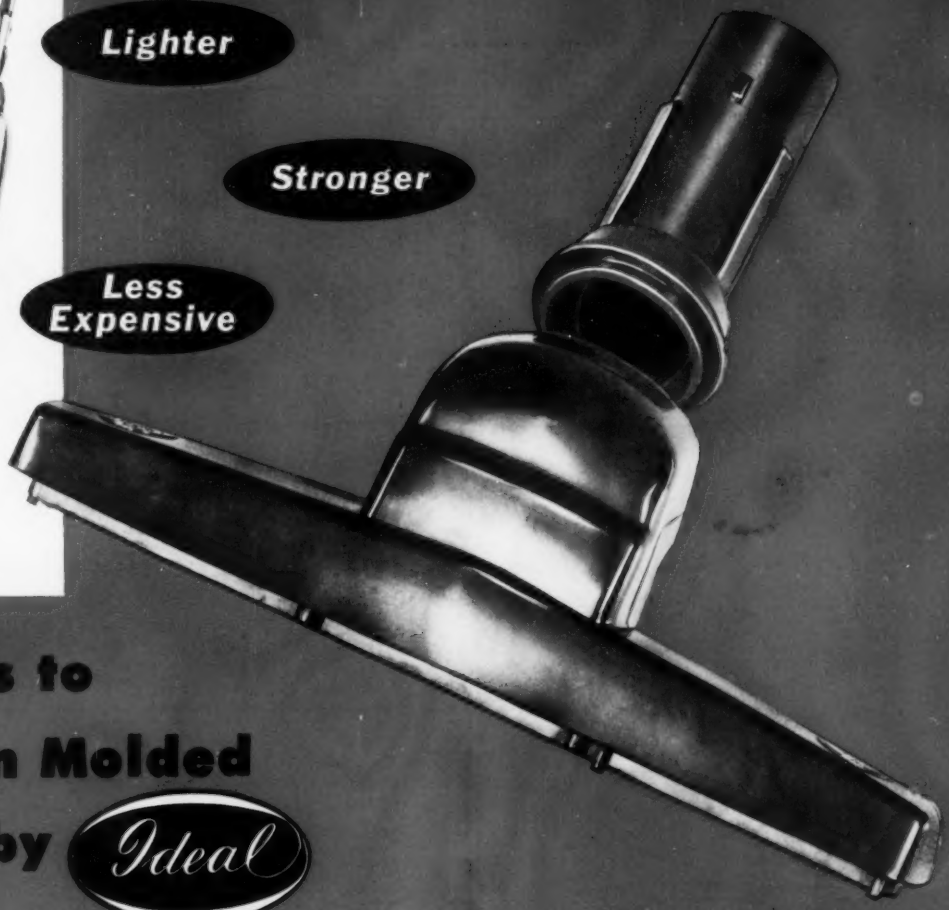
METASAP STEARATES
the cleanest stearates made

Lighter

Stronger

Less Expensive



Thanks to Custom Molded Parts by Ideal

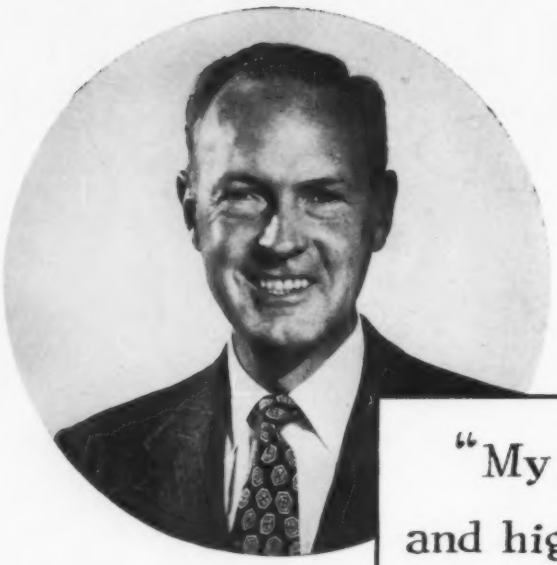
The business end of the famous *Electrikbroom* had to be able to absorb a lot of abuse every time a busy housewife used this light-weight vacuum cleaner. And when The Regina Corporation decided that plastics offered many advantages over the previous nozzle unit which consisted of many parts requiring complicated assembly procedures, Ideal Plastics seemed the logical supplier to fill their requirements.

Ideal's engineers pitched in on the new design, suggesting a number of modifications which made molding less expensive, cut the cost of assembling, and in no way reduced the efficiency of the new parts. When the molds were made, the two pieces were injection molded of damage-defying high impact styrene which Ideal recommended. The rich maroon color is molded-in, so it can never wear off.

If you want to be as completely pleased with your plastics parts as The Regina Corporation is with theirs, call on Ideal. In countless instances we have injection molded major and minor components and entire plastics products for America's foremost companies. Our engineering assistance and cooperative service can be invaluable.

For details on what we can do for you, contact A. C. Manovill, Vice President in Charge of Sales, Ideal Plastics Corporation, 184-10 Jamaica Ave., Hollis 7, N. Y. Phone: AXtel 7-7000.

Better Molded Plastics Ideal *for Industry & Home*



"My need for close tolerance and high production decided me on Bipel auto-control presses"

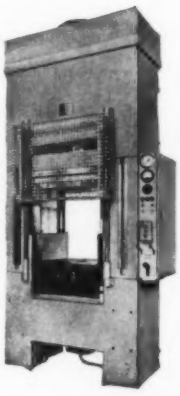
■ Their outstanding production ability and tolerance control when small multi-cavity moldings are involved have clinched many a sale for Bipel down-stroking prefiller presses. Bipel presses show their superiority to best advantage on jobs where cure is short and open press time for stripping, reloading and setting inserts is comparatively long.

On jobs like these, Bipels' extremely fast clamp and transfer yield definite production premiums over conventional press equipment. What's more, the Bipel "auto-control" takes the task of running the cycle out of the operator's hands. Once this mechanism is set, it recreates even the most complicated molding cycle with obsolute uniformity. The results? *Virtual elimination of rejects and materially improved tolerance control.*

BIPEL DRIVES A single central power unit provides inexpensive, trouble-free *medium* pressure to as many as twelve Bipel presses through a unique line feed system. At the press, this pressure is used direct from the line (1:1), or doubled (2:1), or tripled (3:1) at will . . . giving a choice of three working pressures per press!

ECONOMICAL OPERATION Installations of Bipel presses are neat, uncluttered by piping, and extremely compact. For single press operation, a miniature drive unit is built within the press frame. The low cost of installation, operation and maintenance is reflected in lower cost for each individual piece molded.

Bipel presses offer intriguing opportunities to any molder who wants to maintain fine tolerances, increase production, and reduce his costs at the same time. Send today for full details.



Type 40	Type 100	Type 200
20, 40 or 60 tons	50, 100 or 150 tons	100, 200 or 300 tons

American inquiries should be sent to
Ralph B. Symons
Associates, Inc.
3571 Main Road
Tiverton,
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B·I·P GROUP

B. I. P. ENGINEERING LTD.

Aldridge Road, Streetly, Staffordshire, England

The most sensitive "nose" in the world...

Hidden in the nose of the F102, Convair's ultrasonic delta wing, land based jet fighter, are those highly sensitive electronic miracles of science that protect and guide it unerringly to its destination of national defense.

A critical part of these vital instruments of warfare is the reinforced plastic radome produced by Zenith Aircraft.

Because of Zenith skill and exclusive production techniques, these defenders of our country and of the peace of the world can function unfailingly, regardless of temperature, altitude, or climatic conditions.

"Futures Unlimited," a brochure picturing these Zenith activities, is available on request to . . .

ZENITH AIRCRAFT *division of Zenith Plastics Company* **Z gardena, calif.**

WORLD'S LARGEST PLANT PRODUCING REINFORCED PLASTICS FOR AIRCRAFT

Are You BARRED

from planned assembly savings

BY A THREAD?

No MATTER how carefully you plan to take advantage of the proved speed and simplicity of the self-tapping screw *method*, your planning won't pay off if "softies" and "cripples" turn up among the screws you use.

Screws can be "trouble-bent" in many ways. Like the thread faults listed here, most are invisible, but their effects (job slowdown, parts spoilage, high reclamation expense, hidden weakness) show up clearly in mounting assembly costs and customer complaints.

That's why P-K quality standards have been set so high — to make sure you get Self-tapping Screws that are not only threaded, but headed, pointed, and heat-treated with one purpose in mind, to keep your assembly lines trouble-free.

P-K Self-tapping Screws are the leading choice of experienced specialists who plan assembly of America's best known products. Follow their lead . . . for day-in, day-out dependability, specify P-K. For information on any fastening problem, talk to a P-K Assembly Engineer . . . Parker-Kalon Division, General American Transportation Corporation, 200 Varick St., New York 14. Chicago Warehouse, 4331 West Lake St., Chicago 24.

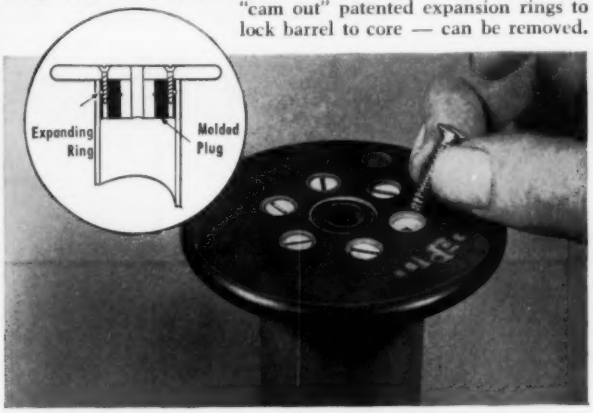
P-K STANDARDS protect you against the thread faults illustrated and many others that will cause assembly trouble and weak fastenings. They don't "get by" P-K inspectors — that's why *all* P-K Self-tapping Screws can be "Guaranteed First Quality."

PARKER-KALON®

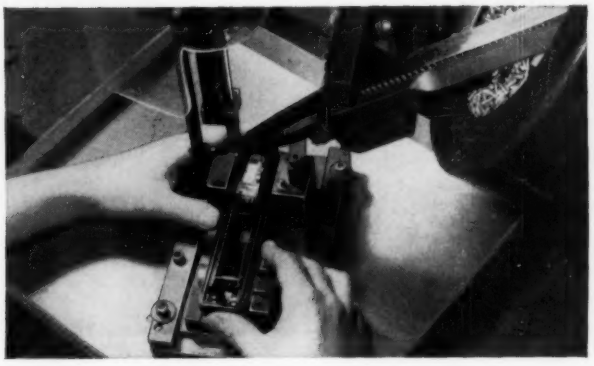
IN STOCK . . . see your nearby P-K Distributor . . .

MIRR-O-LURE, made by L & S Bait Co., Inc., with its lasting, "built-in" iridescence, has remarkable resemblance to live bait, with the same flash and action. It fools fish and hooks them. To make sure it *holds* them, the metal trim is fastened to the Tenite Butyrate body with P-K Type Z Screws. This application is typical of thousands of small products in which P-K Screws save time.

EPI BOBBINS, products of Engineered Plastics, Inc., must withstand extreme end pressure of nylon and other synthetic yarns under tension. Six P-K Type F-Z Screws fasten each laminated phenolic flange securely. Power-driven screws tap into Durez plugs and "cam out" patented expansion rings to lock barrel to core — can be removed.



with P-K quality-planned assembly savings pay off



EASTMAN KODAK speeds up assembly of the Kodalite Flashholder by using P-K Self-tapping Screws. Troublesome tapping of small holes in plastic is eliminated. Screws are driven with hopper-fed automatic machines, removing necessity for tedious screw handling and placement. Two P-K Phillips Head Type F Screws fasten a cover mounting bracket to the flashholder case (right) and three more fasten the metalized Tenite II reflector to the case (left). Case is a thermo-setting phenolic. Screws hold firmly under all stresses of normal use, can be removed for attachment of new reflector.

The First originated by P-K . . . and First Today . . .
the leading choice for fastening economy

SELF-TAPPING SCREWS

your local Supply and Service Specialist

Another new development using

B. F. Goodrich Chemical *raw materials*

Cutaway view of Victor K-4 molded seal showing unique design.

K-4 oil seals, made by Victor Manufacturing & Gasket Co., are installed on International Harvester trucks. B. F. Goodrich Chemical Company supplies only the Hycar rubber.

TRUCK SLOSHES THROUGH WATER SAFELY ...with Hycar bearing seals

THIS truck's front wheel bearings are fully protected from the water and dirt of this big puddle by seals made of Hycar rubber. And just as vital a function—the Hycar bearing seals keep grease in!

This double protection means double savings. These Victor seals made of Hycar assure the long life and efficiency of the wheel bearings. Costly repairs are eliminated because the bearings cannot run dry and foreign matter cannot score their highly polished surfaces.

Hycar rubber is used in many sealing applications — for trucks, passenger cars, tractors and home appliances. Hycar is highly resistant to abrasion and maintains a tight seal under severe operating conditions and a wide temperature range.

Parts made of Hycar can be molded to close tolerances. And—Hycar's resistance to oil, grease and most chemicals makes it ideal for many uses in many industries.

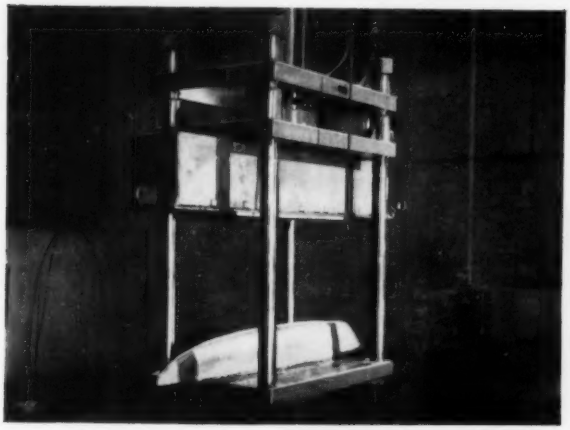
Perhaps Hycar can solve a problem for you—do a job that you thought couldn't be done. We'll help you find the answers—give you technical advice. For information, please write Dept. HV-6, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Hycar
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

users report big savings with sprayed metal tooling



Photos courtesy Narmco Mfg. Co., San Diego, Cal.

Typical glass laminated part produced from sprayed metal tooling in press shown. Match molds for this jet aircraft wing tip were built up with alternating layers of sprayed aluminum and bronze over sprayed zinc base and backed with copper tubing, reinforced and insulated with laminated glass cloth. Tubing carries steam for cure, after which cold water is used to chill male for next layup.

new bulletin provides data round-up on current successful applications

Reports from users of sprayed metal tooling on recent successful applications form the basis for a new data bulletin, now available without charge. These case histories demonstrate the substantial savings in time and money over other tooling methods, point up possible pitfalls that can be avoided in tool design and fabrication.


sprayed metal tooling

Data covers general procedures, describes and illustrates tooling now in use and plastic production parts. Write for a copy of this new data bulletin, or use the handy coupon below.

DON A. WATSON
METALLIZING ENGINEERING CO., INC.
1119 Prospect Ave., Westbury, Long Island, N. Y.

Please send me free copy of Bulletin 111 — Sprayed Metal Tooling. No obligation of course.

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Metallizing Engineering Co., Inc.
1119 Prospect Ave., Westbury, L. I., New York • cable: METCO
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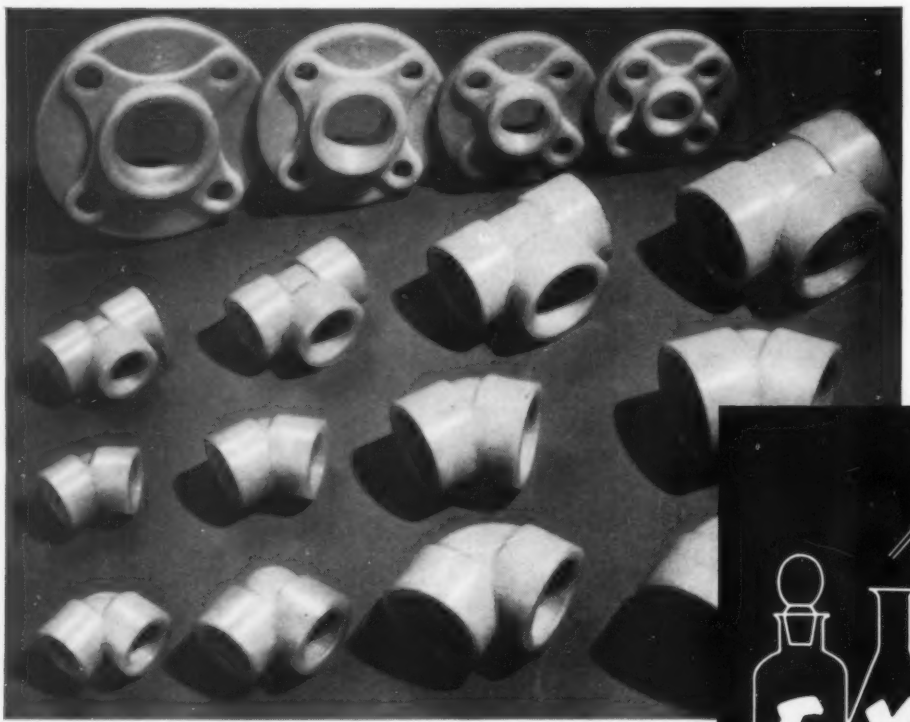
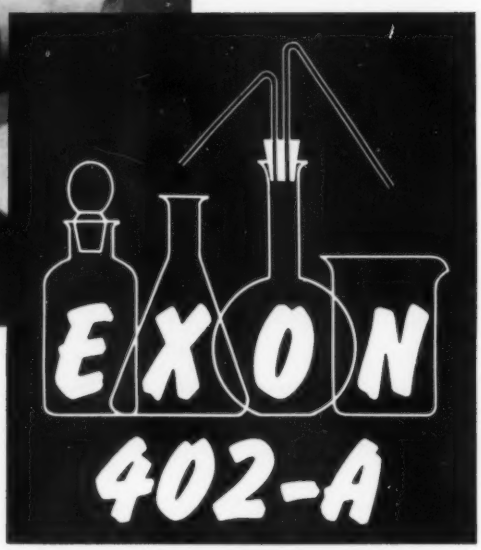
METALLIZING EQUIPMENT COMPANY, LTD.—Chobham near Woking, England

unplasticized P.V.C. now can be **MOLDED** for unlimited low-cost, corrosion-resistant applications





—using **Firestone**

Exon 402-A **truly is a most versatile resin!**

It makes possible molded unplasticized P.V.C.—opens wide new horizons for many low-cost, high-strength, corrosion-resistant applications —in an infinite variety of sizes and shapes.

It's no great news that unplasticized P.V.C. pipe has long been available. But it is exciting news that you can now use Exon 402-A to quickly turn out pipe fittings of Standard I.P.S. sizes ½" through 4", slip-fit or threaded. The products shown here are absolutely uniform . . . with excellent chemical resistance and inertness. Imagine the limitless possibilities this material offers in the pipe field alone!

Exon 402-A used to mold products made of unplasticized P.V.C. could easily end *your* search to cut costs in processing tough, corrosion-resistant products. For complete details on the many advantages, uses and applications of Exon 402-A, contact Firestone today.

for complete information
on the entire line
of Firestone ***EXON*** resins,
call or write:

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Firestone Plastics Company
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Pottstown, Pa.
Division of The Firestone Tire & Rubber Co.

DEEGLAS

GLASS FIBRE MAT

for better mouldings

Just as metal tie-rods increase the strength of concrete, so Deeglas Glass Fibre Mat makes possible stronger plastic mouldings. Deeglas can now be supplied pre-impregnated with a range of resins, e.g. Phenolic pre-preg. Deeglas is suitable for moulding either by pressure or vacuum methods and gives a strength and weight ratio nearly double that of aluminium. These pre-preg. methods have already proved their worth in aircraft, boats and cars.
Deeglas is easy to handle and simple to mould. It has an even distribution of fibre. May one of our Technical Representatives call to discuss your own problems which can be solved by the use of Deeglas mat or any of our other products such as Rovings, Chopped Fibre or Cloth.

Deeglas PUTS **STRENGTH** INTO PLASTICS

For further details and samples of Rovings, Chopped Fibre and Cloth write to:

GLASS YARNS & DEESIDE FABRICS LTD.

Craven House, 121 Kingsway, London, W.C.2. Telephone Chancery 7343

GD.5

THIS TEEN-AGER IS AN Old Timer

There is a teen-ager in the Interchemical family of whom we are mighty proud. His name, if you please, is Mr. I. C. Polyester and he is making quite a name for himself in an industry that is only just as old as he is.

Born in the early days of World War II, his first job was to seal aircraft engine castings to make them oil-tight in order that our nation might have wings.

Raised in the atmosphere of a fine old Interchemical heritage, with its traditions of quality and service dating back over a hundred years, he has grown in stature and versatility until he is now respected as an old timer in the young reinforced plastics industry.

In his sample case he carries a series of resins designed to cover virtually all types of Polyester applications, a line of color concentrates to provide a rainbow of hues, and a fund of "know how" and technical service that makes him an ever-welcome visitor to those who have come to know him.

Wouldn't YOU like to make his acquaintance?

Interchemical Corporation

Finishes Division

Factories: Chicago, Ill. • Cincinnati, Ohio • Elizabeth, N. J. • Los Angeles, Cal. • Newark, N. J. • Mexico City, Mex.

In Canada, IC products are sold by AULCRAFT PAINTS LTD., Toronto, Ont., under its trademarks.

● Large flat areas, points of critical tolerance, gates and runners are particularly susceptible to erosive wear when conventional thermosetting compounds are used. Longer cure times and difficult flash removal are early symptoms of mold erosion—followed by progressive deterioration of molded parts. Such erosion may be reduced as much as 60% with new G-E low-erosion compounds.

General Electric Company
Sect. 417-5A, Chemical Materials Dept.
Pittsfield, Massachusetts

Please send me the following:

( ) Technical data on new low-erosion compounds
( ) A compound sample
( ) Have your representative call to discuss the application of these new compounds

Name_____
Firm_____
Street_____
City_____ Zone____ State_____

COMPARE!

Here is the erosion ratio of the new G-E compound compared with five other leading grades of conventional phenolic material tested by G.E.

COMPOUND	G.E.	A	B	C	D	E
EROSION RATIO*	0.15	1.0	6.3	1.7	2.6	3.3

*Erosion ratio is a numerical value expressing the measured erosive characteristics of the given compound; the lower the value the less erosive is the compound.

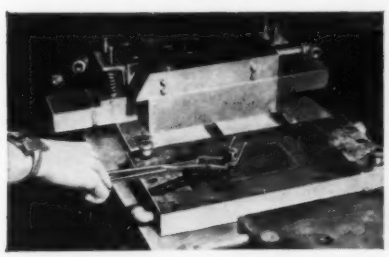
LOW-EROSION MOLDING COMPOUNDS

- **MINIMIZE MOLD WEAR AND DOWN TIME**
- **SAVE ON MOLD REPOLISHING COSTS**
- **KEEP FINISHING COSTS LOW**

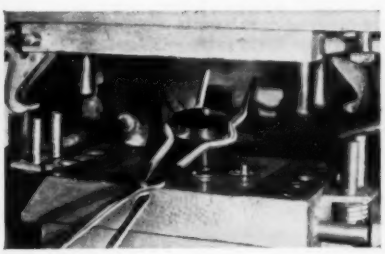
Through the use of radioactive tracer techniques, General Electric has developed a group of *low-erosion* phenolic molding compounds—compounds that minimize the erosive action on expensive molds to a fraction of that experienced with conventional compounds.

Mold erosion can be costly to you—first, perhaps, in increased finishing costs of molded parts as the mold begins to erode, then eventually in the costly process of taking the mold down and having it repolished. Erosion can be a particularly acute problem in large parts with relatively large smooth areas . . . in parts on which extremely close dimensional tolerances must be held . . . and in gates and runners of almost any mold.

Check the table (left) to see the significant difference in erosion rates between these new G-E compounds and several leading conventional compounds. Then mail the coupon (on the opposite page) for complete information and samples to learn for yourself how G-E low-erosion compounds may minimize the mold-erosion problem in *your* plant.



1. In the G-E tracer technique for measuring mold erosion, a radioactive bushing is first placed in the mold.



2. Compound is forced through the bushing into the mold to form a test plug. Microscopic bits of radioactive metal eroded from the bushing permit

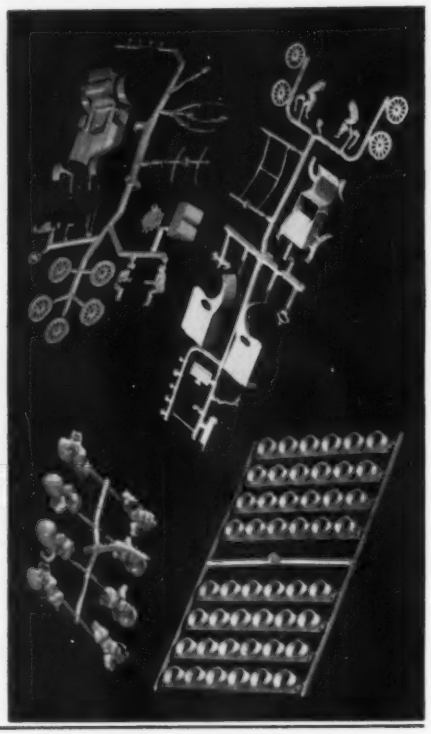
3. ...accurate measurement of any compound's erosive characteristics, through the use of special measuring equipment.

Progress Is Our Most Important Product

GENERAL ELECTRIC

MODEL "4"

A fully-automatic small size machine that molds intricate 2 to 3-ounce large projected area parts originally produced on 8-ounce equipment. New and extremely sensitive controls . . . featuring infinitely variable adjustment . . . provide absolute safety for molds and operators. Molds up to 12" x 23" mounted vertically and up to 13⅜" x 20" horizontally can be used in MODEL "4". Multiple shot injection, ability to mold almost any plastics material, sturdy construction and fast operation assure high production with minimum scrap and maintenance.

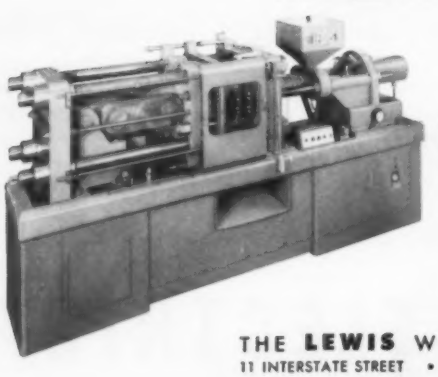


HERE'S WHAT YOU GET WHEN YOU BUY . . .

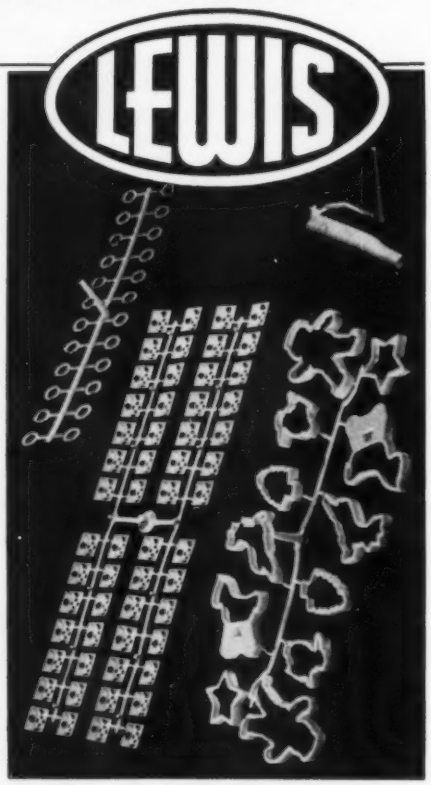
MODEL "6"

Featuring the exclusive new 200-ton "HYDRA-LOCK" clamp, this LEWIS machine does the work of much larger units at a fraction of their initial and normal operating costs. It will plasticize up to 60 pounds of material per hour, and shots greater than 7 ounces (polystyrene) can be produced at rate of 2½ per minute. Quicker, easier mold setting is facilitated by design of the powerful clamp mechanism. Fully automatic operation, 15,000 psi injection pressures, large area platens, compensating feed mechanism, fast opening die-lock device and fingertip controls permit high-speed production with minimum supervision . . . top efficiency . . . complete safety.

3064-LW



For complete data, write for Bulletins 101 (Model 4) and 102 (Model 6).



THE **LEWIS** WELDING & ENGINEERING CORPORATION

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The boy with ideas...

THE NEW "DUTCH BOY" PLASTICIZERS	
Three Double-Duty Primary Plasticizers	
PRODUCT	**USED FOR —**
NL F-41	Outstanding low temperature flexibility Good low volatility
NL F-31	Excellent low temperature flexibility Good low volatility
NL F-21	Good low temperature flexibility Good low volatility
Four High-Purity Standard Plasticizers	
NL C-20 (Di-2-ethylhexyl Sebacate) **NL A-10** (Dibutyl Phthalate) **NL A-20** (Di-2-ethylhexyl Phthalate) **NL A-30** (Di-isooctyl Phthalate)	

You'll get ideas, too . . . once you see what "Dutch Boy" double-duty Plasticizers do for vinyls.

They're the "Dutch Boy's" newest idea . . . first primary plasticizers pre-balanced at the factory for control over *both* low temperature flexibility and low volatility at the same time. In vinyl film, sheeting, extrusions, plastisols and organosols, formulated to premium standards, they reduce cost.

Want *outstanding low temperature flexibility* plus good low volatility? "Dutch Boy" NL F-41 will give it to you. NL F-41 also imparts excellent hand and drape, good heat- and light-stability, low water extraction.

Want *good low volatility* while maintaining good low temperature flexibility? Use "Dutch Boy" NL F-21.

Want *excellent low temperature flexibility balanced with good low volatility* at moderate cost? Try "Dutch Boy" NL F-31.

...this time, it's double-duty plasticizers

Besides the three double-duty plasticizers, National Lead also makes four exceptionally pure, standard-type plasticizers. All seven conform to the high standards of the name you *know* for quality . . . "Dutch Boy."

A leader in stabilizers, too.

Twelve "Dutch Boy" Stabilizers have found their place at the top in vinyl production . . . Normasal for vinyl flooring . . . Tribase & Tribase E for electrical insulations . . . Plumb-O-Sil C for brightly colored translucent film . . . Dyphos for opaque, outdoor products . . . to name a few.

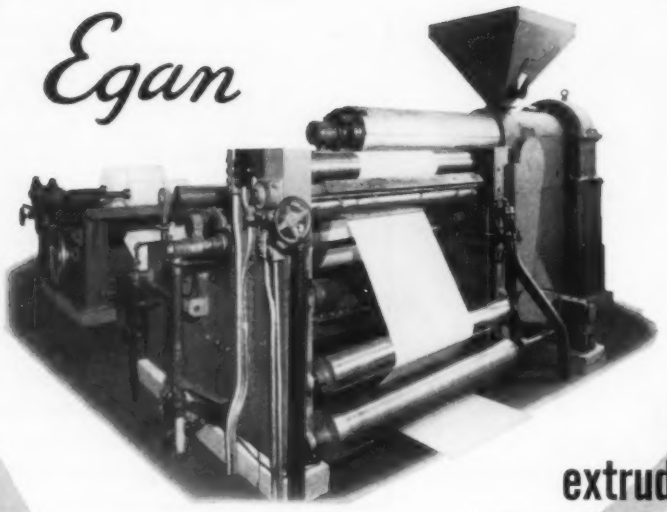
By teaming up these twelve "Dutch Boy" Stabilizers with the seven new "Dutch Boy" Plasticizers, you get a hard-to-beat group of chemicals. Write for detailed technical data . . . on your letterhead, please.

Dutch Boy CHEMICALS

*Reg. U. S. Pat. Off.

NATIONAL LEAD COMPANY
111 Broadway • New York 6, N. Y.
In Canada: **CANADIAN TITANIUM PIGMENTS LIMITED**
630 Dorchester Street, West • Montreal

Egan



polyethylene extruder-laminator

(Above pictured installation at the Milford, N. J. plant of RIEGEL PAPER CORPORATION)

COMPLETE PACKAGED MACHINE

Combining in one unit, in engineered balance, two famous units—The Egan Extruder and the Egan Laminator. Planned for your current—or expanding—production, available in varying sizes—from 24" Pilot Plant Size to 96", 1000 feet per minute continuous operation. Machines are capable of coating on paper and paperboard, cellophane, foil, glassine and cloth.

30 **Egan machines now in operation.**

5 **Egan machines under construction.**
Approximately 75% of all polyethylene extruder-laminating machines now in operation anywhere in the world are Egan Equipment.

FRANK W. EGAN & COMPANY, Bound Brook, New Jersey

Designers and Builders of Machinery for the Paper Converting and Plastics Industries

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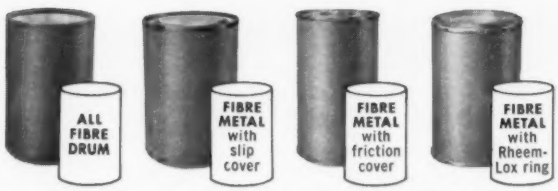

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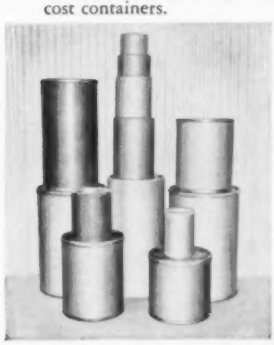

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Choose the size that best fits your needs. Fibre drums from 1- to 32-gallons in capacity; Fibre-Metal drums from 5- to 60-gallons. There is virtually a size for every possible requirement.

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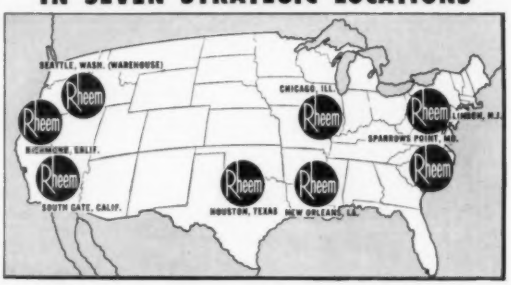

Rheem Fibre Drums are being manufactured in four of these plants. Production lines are scheduled for installation in other plants soon.

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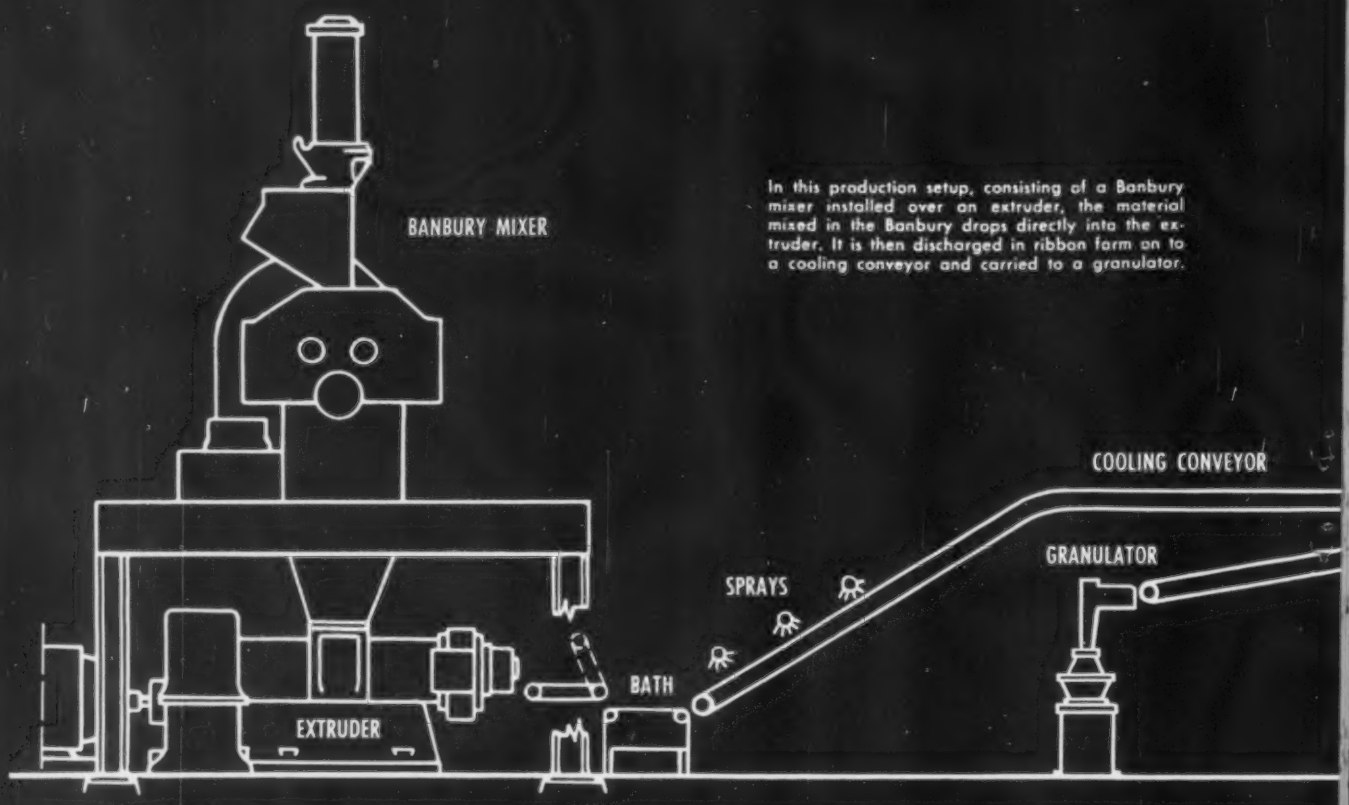
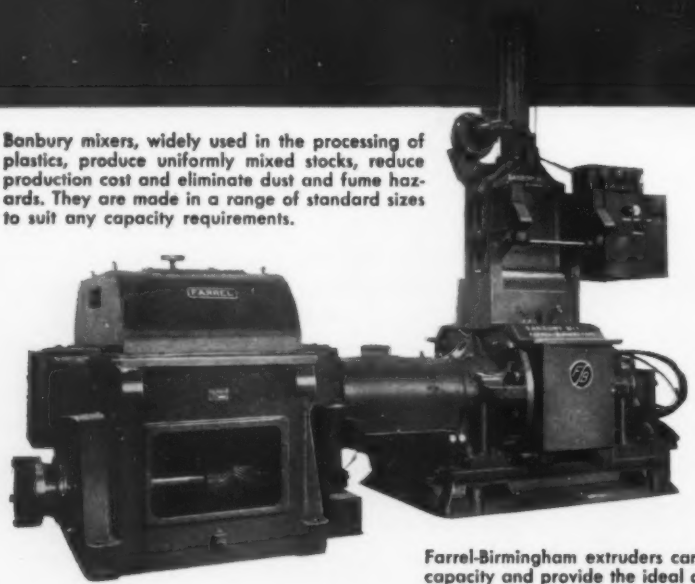
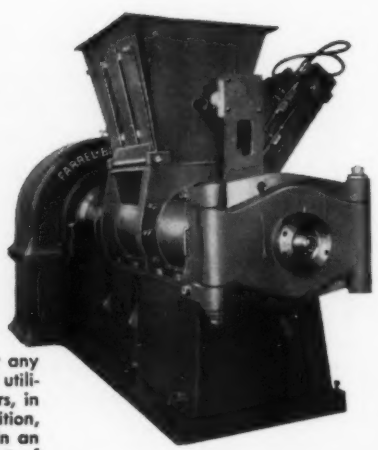


In this production setup, consisting of a Banbury mixer installed over an extruder, the material mixed in the Banbury drops directly into the extruder. It is then discharged in ribbon form on to a cooling conveyor and carried to a granulator.

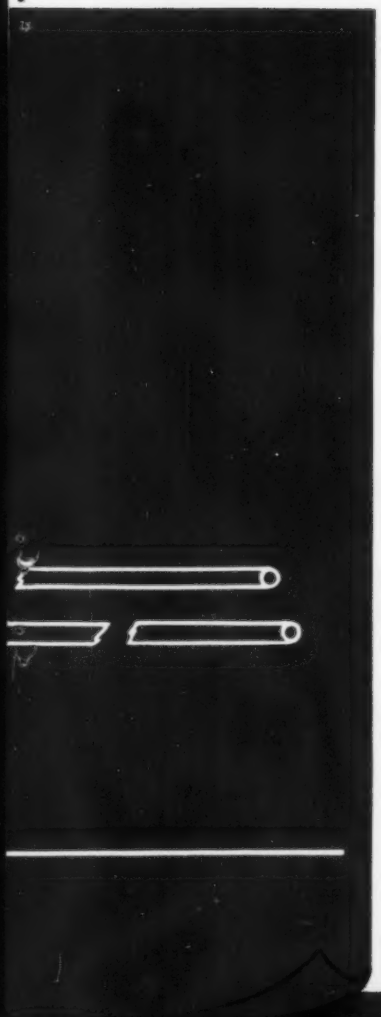
Banbury mixers, widely used in the processing of plastics, produce uniformly mixed stocks, reduce production cost and eliminate dust and fume hazards. They are made in a range of standard sizes to suit any capacity requirements.





Farrel-Birmingham extruders can be built for any capacity and provide the ideal answer to full utilization of maximum Banbury output. Extruders, in most cases, eliminate all hand milling. In addition, stock worked by the screw in a single pass in an extruder chamber is more uniform than that of milled stock.

IMPROVED method of producing plastic materials in granular form



The highly efficient processing system blueprinted here, has been installed by a number of large chemical companies to process plastics in preparation for granulation.

Operation is from a central control panel, and a continuous, even flow of production is maintained at all times by automatic cycle control of the Banbury mixer, with extruder feed regulated to suit the cycle. The material is mixed and blended in the Banbury, and then delivered in chunk form to the extruder, where the stock is further worked by screw action under close temperature control. An air-operated ram in the hopper automatically provides constant feed to the screw. A continuous strip is extruded from the die head through a water bath to a conveyor, where the material is further cooled on its way to the granulator.

Another application for this production setup is for the reclaiming of vinyl scrap. The scrap is mixed and blended in the Banbury, then discharged into the extruder, where it is strained and extruded in strip form for subsequent cooling and granulation.

These production units illustrate the type of service performed by the Farrel-Birmingham engineering planning division, which is staffed by men with great experience in the design, application and operation of machinery built by the company. Two other typical examples are shown below—one for vinyl phonograph record blanks, and the other for plastic film, sheet and coatings.

If you are thinking of modernizing or expanding your facilities, call on Farrel-Birmingham engineers early in the planning stage. They can help you lay out a production unit that will improve efficiency and cut operating costs.

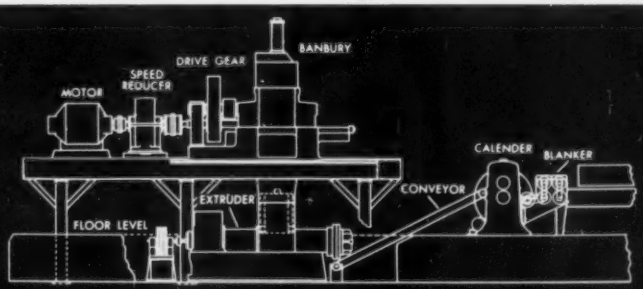
FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo, N. Y. *Sales Offices:* Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston.

Farrel-Birmingham®

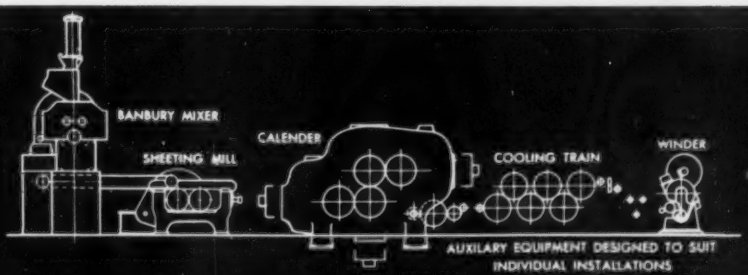
FB-929

Setup designed for the production of blanks from which phonograph records are made. The extruder receives stock directly after processing in the Banbury. The extruded strip is conveyed to the calender and blanking unit.



TWO OTHER FARREL-BIRMINGHAM MATCHED PRODUCTION UNITS

The combination of the Banbury mixer, the two-roll mill and the Farrel-Birmingham "Z" calender has for years been considered "standard equipment" for the production of high-quality plastic film, sheet and coated fabrics. The sizes of these units in relation to one another are established by the type of production, with capacities calculated to permit a continuous and balanced production flow.



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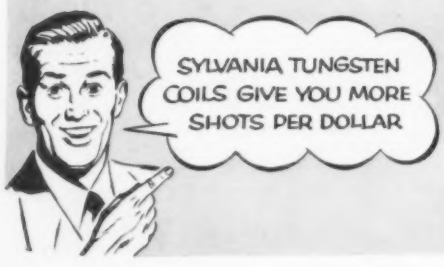
This drawing of 3 and 7 strand wire shows the relative cross-sections under similar conditions. The wires of the larger cross-section give the better performance.

(Initial Cross-Sections Equal)

EVERY step in the manufacture of *new process* Sylvania tungsten from ore to wire is performed in Sylvania's own plants where quality is rigidly controlled. The wire, in either single or multi-strands, is then coiled specifically for high vacuum metalizing. This unique quality control results in tungsten coils that last longer and give far more efficient service.

Sylvania offers a wide variety of new process tungsten coils and wire diameters. Sylvania research, however, has established that a small number of relatively large diameter wires are the most effective and economical type of strand for most types of vacuum metalizing. Sylvania's strand avoids early failures due to rapid diameter reduction inherent in strand made from small size wires. It saves you money, insures a better quality metalized product.

Whatever your vacuum metalizing application, there's a new process Sylvania tungsten coil to do a better job. Or, if you form your own coils, new process Sylvania tungsten wire is yours in a full range of diameters, in stranded cable or single strand. And, if you have any special application problems, Sylvania engineers will be glad to help you work them out.



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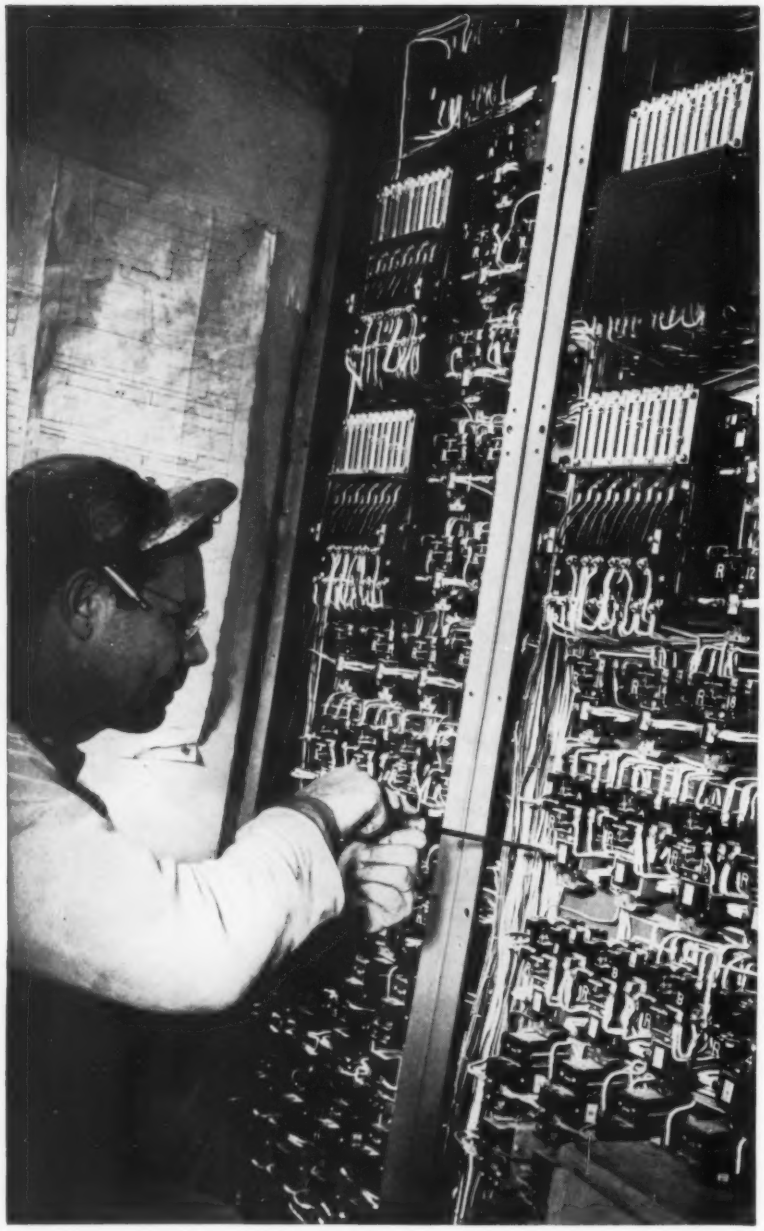

HERCOFLEX 150 IS MADE FOR LIVE WIRES

Complicated electrical installations, like this "switch board" which operates the centrifuge at Hercules' plant in Mansfield, Massachusetts, give longer, more dependable service when vinyl wire insulation is made with Hercoflex 150.

Hercoflex 150, one of a number of Hercules vinyl plasticizers, retains its high dielectric strength even after prolonged exposure to high temperature. And the broad range of useful temperatures observed in vinyls plasticized with Hercoflex 150 is making it increasingly popular not only for extruded wire coatings but also for cable-jacket stock.

Compatible with most primary and secondary vinyl modifiers, Hercoflex 150 can be processed quickly and economically with the various vinyl chloride polymers and copolymers. It has unusually low volatility and is always uniform in quality, properties, and performance.

Hercoflex 150 is readily available. For additional technical data, write Hercules.

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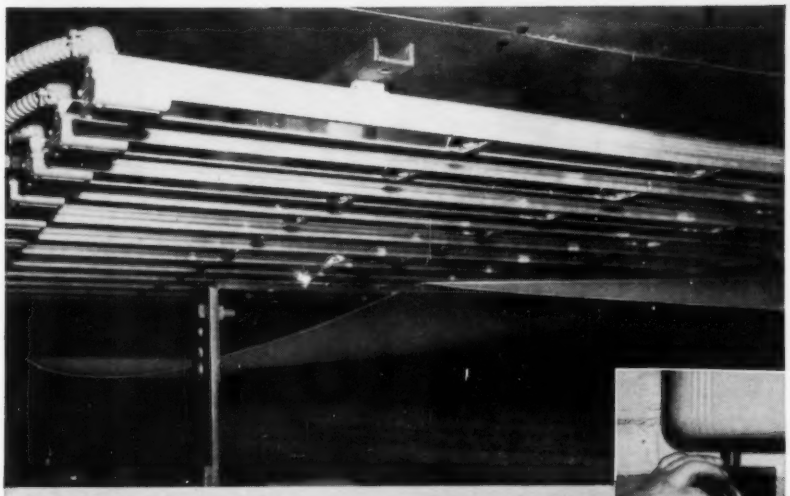
CHROMALOX Production Tips

PROFITABLE IDEAS FOR PLASTIC PROCESSING



$600 vs. $25,000—The *right* heat in the *right* place eliminated the need for an additional $25,000 embossing press! The job was done with eight standard 5-ft. Chromalox Far-Infrared Heaters (shown above) at a cost of less than $600. Vernier control adjusts radiation to match speed and material thickness. These high intensity units doubled embossing speed over the previous rate, take up little valuable space.

UNIFORM, HIGH INTENSITY HEAT AND PRECISE CONTROL RESULT IN HIGH SPEED VINYL FUSING AND EMBOSSING

Many manufacturers of vinyl films are fusing cast vinyl in as little as ten seconds at speeds up to 100 yards per minute! They are obtaining this high speed production without expensive equipment and high pressure steam. Instead they use all-metal Chromalox Electric Radiant Heaters which are economical in initial cost and easy to install, even in existing equipment. Too, they occupy very little floor space.

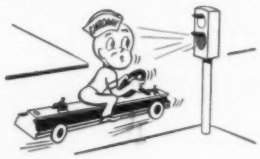
Basic reasons for the success of Chromalox Radiant Heaters in processing vinyls are the high heat intensity, uniformity and the precise control possible with these far-infrared generators.

In usual production procedure, plastisol film requires one minute at 400°F. to fuse in a convection type oven. When the film is processed in a Chromalox Radiant Oven fusing takes place in ten seconds. In the manufacture of organisol vinyl films Chromalox Radiant Heaters perform equally well.

When the vinyl films require embossing or laminating, Chromalox Radiant Heaters do a better job, more quickly in both unsupported and supported films. In film up to 20 mils thick, high-intensity Chromalox Radiant heaters are placed on only one side of the film.

Full details for fusing, embossing and laminating cast and calendered materials are contained in "The Vinyl Report" listed in the right column. Write for your copy.

BEING "COLOR BLIND" IS BIG HELP IN PROCESSING



White or black . . . transparent, translucent or opaque—it makes little difference when Chromalox radiant heat is on the job. That's because the radiation is in the invisible far-infrared wavelength that is absorbed with almost equal speed by all colors and surfaces. Even clear glass and plastics absorb far-infrared readily and heat up quickly.

CHROMALOX APPLICATION DATA TO HELP SOLVE YOUR PROBLEMS

☐ **DEHYDRATING VINYL SHEETS**—How production was increased and rejects reduced in laminating vinyl sheeting between two pieces of plate glass. *Report R-121.*

☐ **FUSING VINYL TO CHIP BOARD**—How Chromalox Electric Radiant Heaters improved quality, reduced heating time and increased production 500 per cent. *Report R-129.*

☐ **HEAT FOR EMBOSSING CHLORIDE PLASTIC WEB MATERIAL**—How twelve Chromalox RAD-6303 Radiant Heaters replaced an inefficient heat source and resulted in lower operating costs, better end-products, and increased production by 50 per cent. *Report 132.*

☐ **FUSING PLASTISOL COATING TO MAKE IMITATION LEATHER**—How preheating, fusing and embossing are performed in a continuous in-line operation using standard Chromalox Electric Radiant Heaters, input controllers and other components. Chromalox Heaters were installed with minimum expense and less time. *Report R-143.*

☐ **VINYL TREATING CLOTH**—Case history of Chromalox Radiant Heaters being used to fuse vinyl into cotton fabric for garden gloves. *Report L-1068.*

☐ **DOUBLING EMBOSSING CAPACITY**—How a $600 investment in Chromalox Electric Heaters saved an expenditure of about $25,000 for additional embossing equipment. *Report L-1086.*

☐ **VINYL REPORT**—An authoritative paper on the use of Chromalox Far-Infrared Radiant Heaters for fusing and embossing cast and calendered materials.

☐ **10 ADVANTAGES OF CHROMALOX FAR-INFRARED**—A quick digest of the pertinent facts which make "color blind" far-infrared the ideal heat source for plastics processors. *CS-604-B.*

☐ **101 WAYS TO APPLY ELECTRIC HEAT**—A 32-page handbook illustrating and describing approved methods of electrically heating processing equipment, liquids, air, etc.

☐ **ELECTRIC HEAT FOR BETTER PLASTICS PROCESSING**—Case studies of how Chromalox Electric Heaters of all types have been used for drying, forming, shaping, fusing, laminating, molding and other uses in the plastics field.

☐ **CHROMALOX CATALOG 50**—Complete application details, specifications and other data on over 15,000 types, sizes and ratings of Chromalox Electric Heaters.

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This balanced combination of important properties has led to its extensive use in all types of vinyl compounds including calendered and cast films, calendered sheeting, calendered and dispersion coated fabrics, and all types of extruded products.

Why not give your product better performance and extra sales-appeal by using DOZ or DIOZ. Write to Dept. F-12 today for descriptive literature and samples of Plastolein 9058 DOZ (di-2-ethylhexyl azelate) or Plastolein 9057 DIOZ (di-iso-octyl azelate).

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MODERN PLASTICS

DECEMBER 1954 VOLUME 32 NUMBER 4

PLASTICS VS. HEAT and COLD

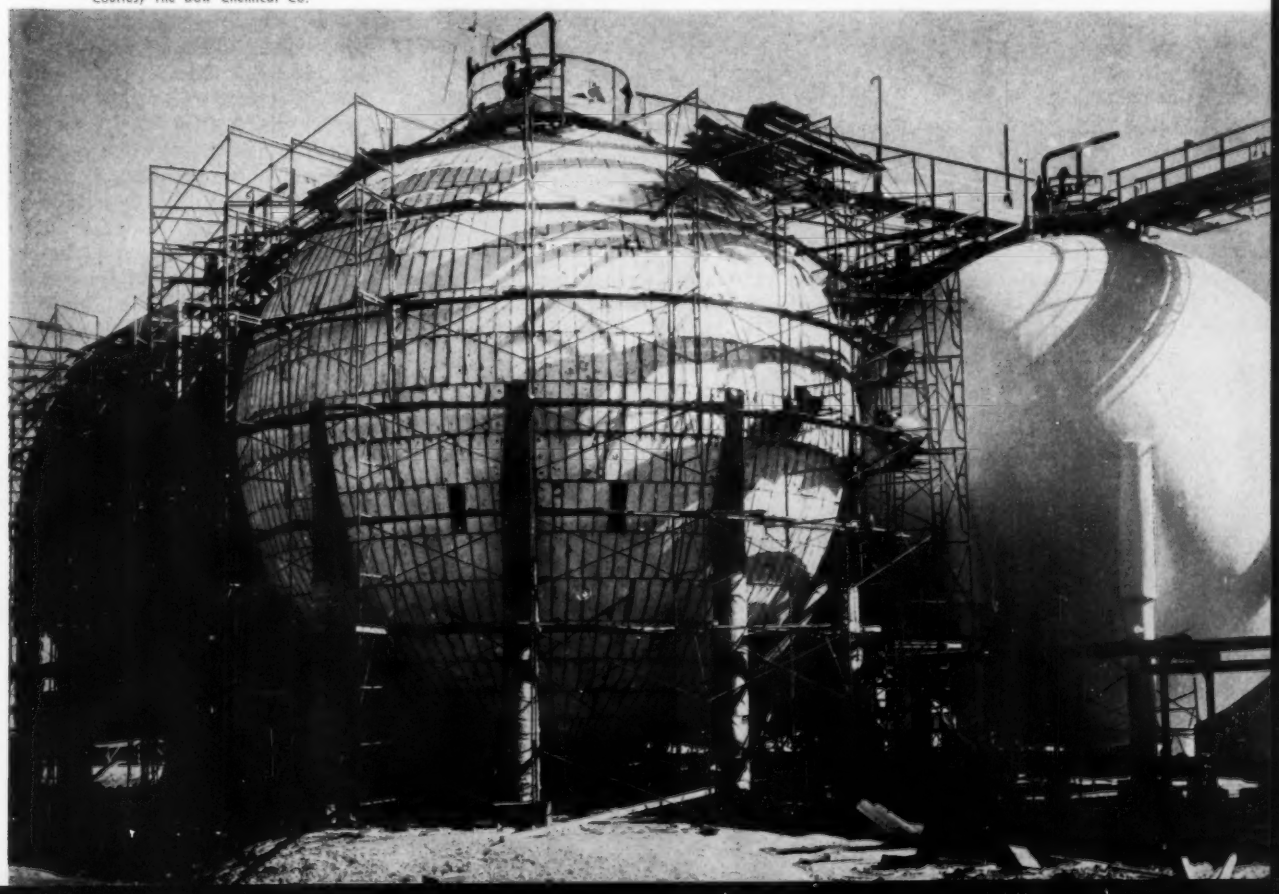
Thermal insulation, important in refrigeration, air conditioning, building construction, and the processing industries often demands combined properties which only plastics can offer

AS EVERY high school boy is taught, the purpose of thermal insulation is to keep heat in or out. The Cold Bar military clothing of the United States Army is designed to keep body heat within the garments; the insulation in a refrigerator is designed to keep heat outside the box.

The function may be performed in a number of ways. Shiny materials may be used to reflect heat rays back toward the source, preventing passage; non-conductors of heat may be used as thermal barriers; materials which absorb heat, such as gases or liquids, can be used in special applications.

Regardless of form, it is basic that a thermal insulating material must not absorb moisture which would

Precut slabs of polystyrene foam are effectively used to provide thermal insulation for these 43-ft. diameter Hortonspheres
Courtesy The Dow Chemical Co.



Courtesy United States Rubber Co.

Foamed modified vinyl in mittens, boots, and Cold Bar suit worn by soldiers gives excellent protection against extreme cold. Low moisture absorption characteristic of the foamed material makes it effective even after long immersion

Plastics of various kinds have a number of properties which make them presently or potentially valuable as thermal insulating materials. In their more familiar molded forms or in the form of film or sheet, plastics in general are found in many applications where their low thermal conductivity is, at least, an advantage and, at best, the deciding factor in material selection. In the relatively new form of foams, several plastics offer improved heat insulation values plus light weight and other desirable properties.

Foamed polystyrene at present leads the parade. But other materials are bidding for their share of existing and prospective markets. The accompanying article has been prepared to sketch the broad picture of the requirements which thermal insulation must meet, to outline current progress in this field, and particularly to place in proper perspective the more recent developments which hold promise for the future.

lessen its effectiveness and must not decay physically or in insulating (K) value. In addition to these requirements, the specialized needs of modern industry make it imperative in some cases that thermal insulation materials also have chemical resistance, good dielectric strength, and act well as moisture-vapor barriers.

Low thermal conductivity is a natural property of all plastics. This —coupled with moisture resistance, chemical resistance, light weight, good electrical properties, and the ability to be processed in a wide variety of forms—makes plastics prime materials for the purpose.

Plastics as thermal insulators are moving into important new assignments. They are competing not only among themselves, but also against traditional insulating materials which have been known and used for many years. To the extent that they can prove their functional superiority over these materials, or pave the way to faster, better, or more economical manufacturing methods in such fields as refrigeration, air conditioning, and industrial and domestic building construction, these materials may be counted upon to open up huge new market outlets for plastics.

Plastics as thermal insulators are not always used by themselves. Indeed, many of their most effective applications in this field are in combination with other materials. This versatility is all to the good, since it greatly multiplies the opportunities for use in scores of ways in the broad fields of manufacture and construction.

Binders

One of the oldest and most familiar applications of plastics in the battle of heat *vs.* cold is in the form of a binder for such conventional insulating materials as mineral wool, fibrous glass, etc., used by the millions of pounds annually in all types of building construction, as well as in many types of electric appliances. The plastic customarily used for this purpose is a liquid phenolic resin. Diluted with water, the resin is sprayed into the base material so that the result is durable, easy-to-handle batts which will hold their shape to permit convenient installation. Such products are unaffected by moisture or temperature extremes.

Phenolic binders continue to find wide usage in the production of conventional types of insulation, but they are only a small part of the total picture. Several types of plastics foams, having excellent insulating properties in their own right, have appeared on the scene. In addition, new plastics films open up other possibilities in the thermal insulation field.

Aside from those applications in which a plastic material is used solely or primarily for its thermal insulating value, there are many products in which plastics, in one form or another, contribute thermal insulation along with other properties. For example, the ability of vinyl to withstand extremes of temperature is demonstrated by such products as Sno-Gel bricks, produced by Sno-Gel Co., Azusa, Calif. These are heavy-gage electronically welded vinyl bags containing a solution which may be frozen hard to serve as a "cold storage battery" in picnic coolers, etc., or warmed by placing in hot water if a source of continuing heat is desired.

Home refrigerators and freezers incorporate a number of plastic components in which thermal insulation is a basic consideration. Prior to the widespread use of plastics in refrigerators, many manufacturers utilized sheet metal inner door liners. Being excellent conductors of

Photos courtesy The Dow Chemical Co.

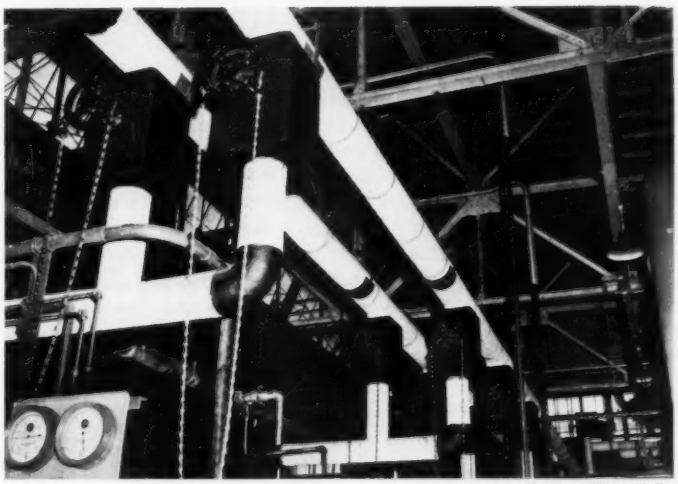
Cold storage room is thermally insulated by applying several layers of foamed polystyrene to walls, using cold-setting asphalt or cement mortar

heat and cold, such liners were much less efficient from a thermal insulating standpoint than the plastic liners in universal use today, most of which consist of molded styrene, formed styrene or styrene alloy sheet, or paper-base phenolic laminate. The same applies to various other components, such as baffle plates, evaporator doors, butter keepers, etc., where it is important to keep temperatures uniform.

In hundreds of civilian, military, and industrial products, the thermal insulating properties of plastics contribute to greater user comfort or operating performance, even though the primary reason for their use may be other than thermal insulation. Typical examples which might be cited include coffee maker and cooking pan handles, molded housings for electric mixers and razors, toaster bases, hair dryer hoods, etc., as well as the countless molded plastics electrical parts for aircraft engines and other equipment in which excellent resistance to both high and low temperatures is imperative.

Film

The unusual heat resistance of Du Pont's new Mylar polyester film, coupled with its extreme toughness and other properties, makes the material ideally suited as an outer protective covering for cork and other forms of primary thermal insulation. A typical application consists of Mylar laminated to aluminum foil, used to seal the exterior surface of ground cork pipe covering. In appli-



Courtesy The Dow Chemical Co.

Expanded polystyrene jacketing is used to insulate low-temperature lines in ammonia plant; corrosion and rot resistance of the foam assures long service life

Courtesy Sno-Gel Co.

Use of vinyl film in double walls of zipper bag (shown open and closed) contributes to its thermal insulation. Vinyl bag in foreground contains material that may be frozen solid and used as "cold storage battery." Vinyl is not affected by freezing the material, keeps it frozen for long periods

One of the most frequently used terms in thermal insulation work is the *K factor*. It is defined as the coefficient of heat transmission expressed as the quantity of heat (B.T.U.) that flows in a unit of time (1 hr.) through unit area of barrier (1 sq. ft.) of unit thickness (1 ft.) having unit difference of temperature (1° F.) between its faces.

The *K* factor varies greatly for different materials. For metals and alloys *K* is high, while for certain insulating materials (plastics, asbestos, etc.) *K* is very low. In general, *K* varies with temperature.

The following is a list of approximate *K* values at room temperature for some metals and insulating materials.

Material	*K*	*Material*	*K*
Aluminum	116	Asbestos	0.13
Steel	26	Cotton	0.34
Copper	222	Glass	0.5

These values are presented here for purposes of comparison with *K* values for plastics materials discussed in the text.

cations of this type, the moisture resistance of the polyester film helps to shield the cork against moisture, thereby maintaining insulating effectiveness. Having the ability to remain flexible and stable at temperatures ranging from — 140 to 302° F., Mylar film is also at least twice as strong as other commercial films. Thus it may be used in thin gages.

Foams

In the field of thermal insulation, plastics in expanded or foam form have already made important progress. Most of these developments have involved low-temperature applications, although certain types of plastic foams have remarkable resistance to elevated temperatures. With several types of plastic foams now in commercial production and much research work in progress pointing toward improved properties, lower costs, and broadened applications, the next few years should witness some sensational advancements by plastic foams as thermal insulation.

The principal stimulus to the development of new plastic foams with varied and improved properties stemmed from knowledge obtained by our technical teams working abroad after the war. Two major developments included the successful foaming of vinyl chloride polymers, to be either as flexible as rubber or as rigid as rock, and the reaction of selected polyester resins with certain diisocyanates, producing foams of controlled rigidity, strength, and density for "in place" applications. It was not long before American industry introduced similar foams, improved in properties and processes, and subsequent progress has been rapid. Newest addition to the rapidly growing family of plastic foams is expandable polystyrene, introduced this year by the Chemical Div. of Koppers Co., Inc.

Plastic foams are highly specialized materials, offering the manufacturer and the refrigeration engineer numerous properties not available in traditional insulating materials based on vegetable or mineral fibers. Foamed-in-place insulation for refrigerators, freezers, and related appliances has long intrigued refrigeration engineers, but has not yet reached the production stage. That manufacturers are actively thinking along these lines is evident from the following significant statement recently made by R. E. Wallenbrock, Refrigeration Div., International Harvester Co.:

"The ageless idea of foaming a refrigerator cabinet or door is still appealing to our industry. Design work has always heretofore been inhibited by the limitations of the foam material. Recently, progress made by polystyrene foam manufacturers has looked very encouraging. Foaming in place or in special molds seems the most practical design approach. Better insulating values with lower densities are still desirable. Better processing and con-

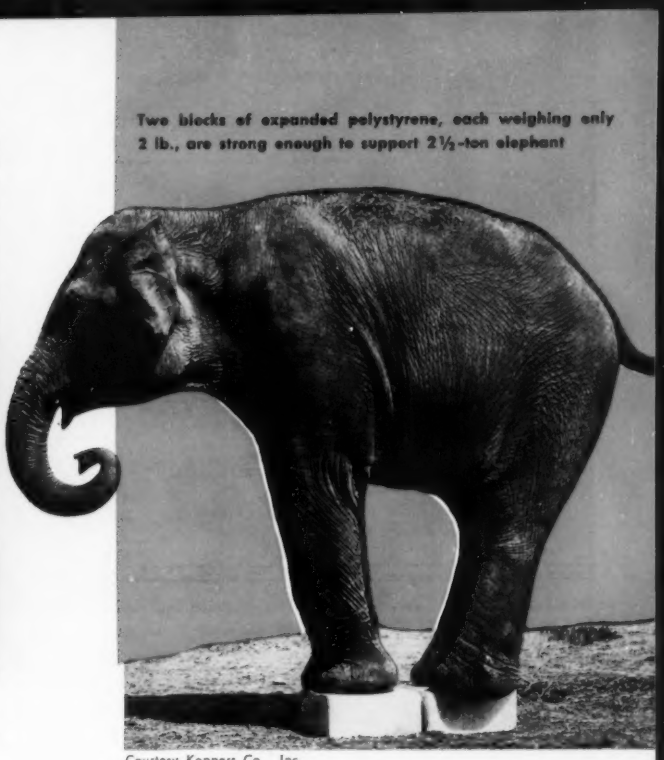
Fabricated rigid sections of expanded polystyrene board are installed in coil box of an automotive air conditioning unit to provide effective thermal insulation. Light weight of the material helps to hold the dead weight of the cooling system to an absolute minimum

Photos courtesy The Dow Chemical Co.

Courtesy Owens-Corning Fiberglas Corp.

Large-diameter pipe is insulated with fibrous glass-reinforced phenolic. Material is premolded into curved shape to fit closely around pipe

Two blocks of expanded polystyrene, each weighing only 2 lb., are strong enough to support 2½-ton elephant



Courtesy Koppers Co., Inc.

trol methods are also necessary. It may soon be practical to combine foams with very thin postformed plastic skins to produce sandwich constructions with intricate shape."

Foamed in Place

Currently available plastic foams or expanded plastics fall into the same two major categories which distinguish all plastic materials—thermoplastic and thermosetting. Some of them are capable of being expanded *in situ* through application of heat or combination with selected chemicals which act as blowing agents; others are supplied in the form of boards, rods, blocks, etc., which may be fabricated to shape and dimension with ordinary wood working tools. Due to their cellular structure and the resultant entrapped air space, all of the plastic foams exhibit noteworthy thermal insulating properties. They exhibit wide differences, however, in such properties as high temperature resistance, water absorption, and chemical resistance.

The following summary, though not all-inclusive, covers the principal types of plastic foams now commercially available in this country, with special reference to their use as thermal insulating materials:

POLYSTYRENE: Styrofoam, a product of The Dow Chemical Co., was first produced in commercial quantities in 1943 and is currently the most widely used type of expanded styrene. A plastic foam composed of a non-interconnecting cell system, it is produced by expanding styrene approximately 40 times, resulting in a material possessing most of the characteristics desired in low-temperature insulation—excellent resistance to water and water vapor, good thermal properties, extreme light weight, and ease of workability. Lightest of all rigid type insulation materials, Styrofoam has a density of 1.6 to 2.0 lb. per cu. ft., making it easy to install economically in larger pieces than feasible with heavier types of insulation. The material has an excellent K value of 0.23 to 0.28 at a mean temperature of 40° F. (see explanation of "K" in panel on opposite page).

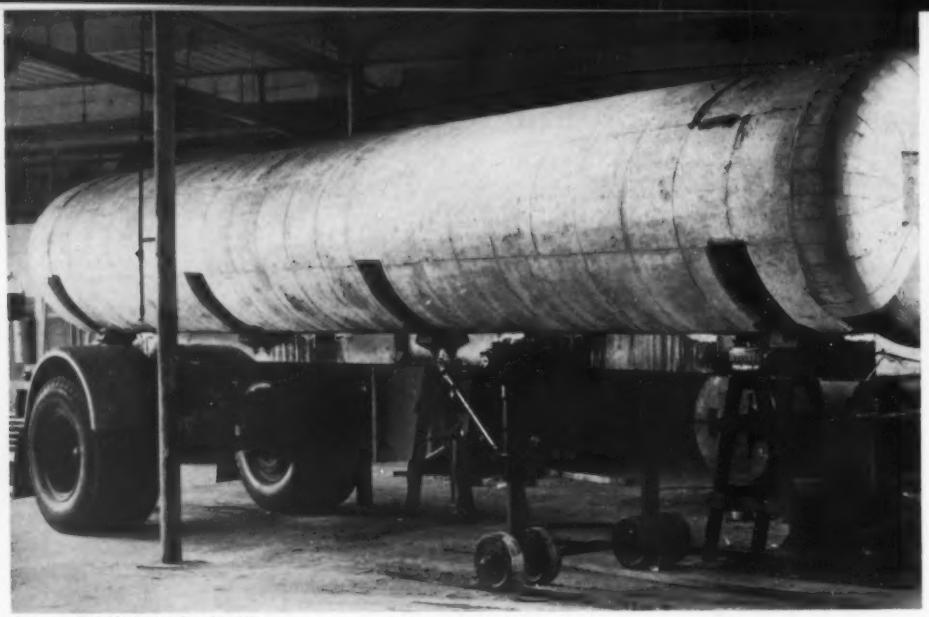
Produced in board form, Styrofoam is easily cut and handled and does not delaminate in service. Highly resistant to rot or fungus growth, the material has no food value and does not attract insects or rodents; in addition, it is odorless and does not contribute odor or taste to foods.

Styrofoam is widely used as a low-temperature insulating material for walls, floors, roofs, ceilings, sidewalks, and for various types of domestic and industrial refrigeration equipment. The 3500 lb. per sq. ft. average compressive strength of Styrofoam boards means that concrete floors can be poured directly over the material without additional support, and that the foamed plastic can also be used in the construction of self-supporting partitions.

Styrofoam can be adhered to walls by means of a cold-setting asphalt or Portland cement mortar. It is customarily installed in two or more layers with all joints staggered. The second and subsequent layers are adhered to the first by means of the same type adhesives and also fastened with treated hardwood skewers pushed into the foam. The interior face of the insulation may then be finished with plaster without the need for metal reinforcement, and subsequently painted.

This foam material is also finding increasing use in the construction of refrigerated trucks, tank trailers, and railroad cars because, in addition to its excellent insulating values, it is non-friable and sufficiently rigid to withstand the vibration to which such vehicles are subjected when in use.

This form of styrene foam is also finding many applications in the construction of refrigeration equipment, including domestic refrigerators, home freezer units and water coolers, milk coolers, ice cream cabinets, etc. The rigid form of the material eliminates furring, ribs, and



Courtesy Carl N. Beetle Plastics Corp.

Fibrous glass-reinforced polyester tank trailer, for use in hauling liquid formaldehyde, is thermally insulated with curved slabs of polystyrene foam covered with a thin laminated shell

Courtesy Owens-Corning Fiberglas Corp.

Phenolic resin serves as binder for fibrous glass insulating batts

metal-to-metal contact of inner and outer cabinet casings which cause high heat losses, corrosion, and condensation within the cabinet. In some installations where the void to be filled is irregular in shape or inaccessible, shredded Styrofoam sealed in polyethylene bags has provided an excellent answer to the insulation problem.

In the construction of its Refrigair automotive air conditioning units, made in 2- and 2½-ton sizes, A. R. A. Mfg. Co., Ft. Worth, Tex., utilizes Styrofoam to insulate the cooling case. Supplied in rigid board form in 1-in. and ½-in. thicknesses, the material is cut to size and placed in the coil box of these units, remaining in position without the use of an adhesive.

Newest type of styrene foam to reach the market is expandable polystyrene beads[1], introduced by Koppers Co., Inc. With this material, for the first time, polystyrene can be foamed to shape in a single operation by industrial processors, eliminating shipping and storage of large, low-density sheets and blocks. Marketed as tiny, hard particles of styrene incorporating a blowing agent, this material requires only the application of heat to produce a 20 to 30 fold expansion in volume. By confining the styrene beads in a mold during the heating process, intricate, expanded objects of controlled densities can be produced simply by controlling the quantity of material placed in the mold. In addition to its ability to be expanded to shape, this new polystyrene foam has such other attributes as toughness, high strength-weight ratio, low water absorption, low water vapor permeability, low thermal conductivity, low dielectric constant, and low loss factor.

Because of the foam's non-connecting cell structure and small size, it is an excellent low-temperature insulating material, having a K value ranging from 0.214 at an average mean temperature of 19.9° F. to 0.267 at 120° F. These figures are based on foam having a density of 2.5 lb. per cu. foot. Since the material is thermoplastic in nature, its

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Courtesy United States Rubber Co.

Truck cab component is insulated with foamed vinyl. A thickness of 5/16 in. of this material has proved adequate in protecting heated cabs against arctic cold

[1] See "'Popcorn' Plastic," Modern Plastics, *31*, 103 (May 1954).

International Plastics Meetings

A brief report from the field sketches the activities, accomplishments, and plans of a number of international groups that convened recently in Europe

SEVERAL international conferences of considerable significance in the plastics field were held in Europe during September and October. These included the 1954 meeting of Technical Committee 61 on Plastics of the International Standardization Organization (ISO/TC 61) in Brighton, England, October 4 to 8; the Symposium on Macromolecular Chemistry held in Milan and Turin, Italy, September 26 to October 2, under the auspices of the Macromolecular Commission of the International Union of Pure and Applied Chemistry (IUPAC); and the 1954 Kunststoff-Tagung which was held in Stuttgart, Germany, October 11 to 14.

ISO Standardization Committee

The meeting of ISO/TC 61 in Brighton was concerned with the international standardization of testing methods and nomenclature. It was attended by 57 delegates from 10 countries, as follows: Belgium 2, France 7, Germany 6, India 3, Italy 5, the Netherlands 4, Sweden 6, Switzerland 1, United Kingdom 14, and United States 9. The U. S. delegation consisted of Robert Burns (Leader), Bell Telephone Laboratories; C. Ainsworth, American Standards Association; C. Condit, Society of the Plastics Industry; L. Gilman, Picatinny Arsenal; G. M. Kline, National Bureau of Standards; R. R. Winans, Brooklyn Navy Yard; R. K. Witt, Johns Hopkins University; E. Y. Wolford, Koppers Co.; and W. A. Zinzow, Bakelite Co. G. M. Kline (U.S.A.) and H. V. Potter (U.K.) presided as Chairman and co-chairman, respectively; C. Condit (U.S.A.) and H. T. Lawrence (U.K.) served as technical secretaries for the meeting.

Another milestone in the work of this committee was reached when the Plenary Session on October 8 approved five test methods as Draft ISO Recommendations. These relate to the determination of water absorption, apparent densities of molding powders pourable and nonpourable from a funnel, acetone soluble matter in phenolic moldings, and the problem of temperature of deflection under load.

In addition, eight items were approved for circulation as Draft ISO Proposals. These pertained to a glossary of equivalent terms in English and French, determination of flexural properties of rigid plastics, standard conditioning of plastics prior to testing, standard laboratory atmospheres for testing plastics, determination of free phenols and of ammonia in phenol-formaldehyde moldings, determination of percentage of methanol soluble matter in polystyrene, and the investigation of boiling water absorption characteristics of plastics.

Many other testing methods are being drafted by the six working groups, each of which held three or more sessions during the week. These working groups are dealing with nomenclature, mechanical strength properties, thermal properties, physical chemical properties, chemical and environmental resistance, and testing and conditioning atmospheres.

The committee voted to submit a proposed modification of the scope of its work to the national member bodies for approval. The new scope would include work on specifications as well as the present assignments on testing procedures and nomenclature. Resolutions proposing cooperation with ISO/TC 5 (Pipes) on the preparation of standards for plastics pipes and with IEC/TC 15 on electrical test methods were also adopted. The cooperation with the latter committee of the International Electrotechnical Commission will be implemented by the formation of a working group to review the electrical test methods prepared by IEC/TC 15 and comments received from ISO member bodies and to prepare recommendations for consideration by ISO/TC 61 and IEC/TC 15 regarding the adequacy of the methods for testing plastics. It was also de-

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Table I — World Production of Plastics

Year	World tons	U. S. Total tons	U. S. %	Germany Total tons	Germany %
1939	300,000	100,000	33⅓	100,000	33⅓
1944	600,000	330,000	55	250,000	42
1950	1,500,000	1,030,000	68.5	100,000 West	6.7
				30,000 East	2.0
1951	1,800,000	1,160,000	64.5	170,000 West	9.5
				35,000 East	2.0
1952	1,800,000	1,110,000	62	190,000 West	10.5
				45,000 East	2.5
1953	2,100,000	1,320,000	63	240,000 West	11.5
				60,000 East	2.85

New Prospects for Polyethylene

COLLAPSIBLE polyethylene tubes—claimed to be the first such tubes in broad commercial production in this country—and a special type of low-cost, squeeze-to-use polyethylene bottle are teamed up in a new line of containers that is rapidly gaining prominence in the packaging field.

Only recently introduced, the tubes and bottles are already being used—in national distribution or in market-testing stages—for a number of well-known products that range from specialty items such as paste and glues to low-profit-margin, mass-market merchandise such as cosmetics or foods. At the same time, according to Bradley Container Corp., Maynard, Mass., producers of the line, the advantages inherent in the production and decorating techniques used in the manufacture of the containers are expected to do much to develop future potential markets for polyethylene packaging—so much so, in fact, that Bradley predicts that its current production rate of ½ million units a week will be quadrupled within a year.

The major difference between the conventional polyethylene squeeze bottles and the new containers revolves around the production technique. The body of the Bradley tubes and bottles, which are trade named "Bracon," is a cylindrical sleeve formed by an extrusion process over a mandrel. According to Bradley, the wall sections of this extruded sleeve can be made thinner and more uniform than would be possible with injection molding or blow molding techniques.

After extrusion, the sleeve is cut to the desired length and a molded polyethylene head with a narrow threaded neck to accommodate the cap is attached to one end. This "heading" operation is accomplished by applying radiant heat to both head and body and then holding the two parts under pressure until they are fused together.

Since the bottles and tubes are then filled through the open bottom, the container heads can be provided with integral valves and with a variety of restricted neck openings that enable the package contents to be dispensed one drop at a time, in spray form, or, as would be required for heavy pastes or ointments, to be simply oozed out of the container. Automatic, high-speed equipment can be adapted to the filling job, thereby lowering packaging costs and increasing output.

Sealing the Bottoms

Filling equipment is also usually modified to perform the job of sealing as well. To seal the bottles, a polyethylene disk is fused into the cylindrical open bottom using the same radiant heat-pressure technique employed for attaching the heads; to seal the tubes, the bottom edges of the cylindrical body are first heated and then crimped tightly together by cooled metal jaws.

To add to the merchandising appeal of the containers, Bradley claims two other innovations: 1) incorporation of roller-offset printing of the tube and bottle bodies as an integral part of the production process; and 2) perfection of an

FOR LIQUIDS

Photos courtesy Bradley Container Corp.

When polyethylene tube is gently squeezed, eye lotion is released, a single drop at a time; an integral valve in nozzle of tube controls release of the liquid

FOR POWDERS

Talcum powder, dispensed from the polyethylene bottle, emerges in the form of a fine spray

Containers

Versatile squeeze-to-use polyethylene tubes and bottles for the packaging field are produced by an extrusion-fabrication technique

electronic process that enables filled polyethylene packages to be sterilized without softening the material. Since the printing takes place while the polyethylene cylinder is still on the mandrel, a higher quality of detailed reproduction is possible. The sterilizing is accomplished with a 2 million-volt particle accelerator that does not affect the polyethylene itself; the action is only that of sterilization.

Applications

The polyethylene tube, which does not roll up like a metal tube during use but must be compressed by squeezing for each expulsion, and the polyethylene bottles are adaptable to the packaging of many products. Initial development work, however, has been concentrated in four fields:

1) Pharmaceutical—Possible applications include nasal sprays, one-drop packages for eye and ear solutions, containers for medicinal ointments and jellies, and spray dispensers for antiseptic powder.

2) Consumer chemicals—In this category are containers for adhesives and glues, tubes for children's finger paints, packages for caulking compounds and greases, and dispensers for liquid detergents.

3) Cometics—Under development—and, in many cases, in the test-marketing stage—are containers for bath talc, eye drops, deodorants, shampoos, and similar toiletries.

4) Foods—One-drop liquid saccharine dispensing tubes are already being manufactured and dropper packages for mustard, syrup, jellies, cheeses, etc., are being tested.

. . . And still under wraps are a number of other applications that promise to contribute much to the future of polyethylene in the packaging field.

Polyethylene bottles are automatically filled through the open bottoms

FOR PASTES

By compressing polyethylene tube for each expulsion, library paste is neatly applied; metal tubes previously used had to be twisted and rolled up to release all the paste

Thicker materials, such as waterless hand cleanser pastes (above), can also be packaged in the new tubes

Motorized Miniatures

Success of scale-model cars and trucks, molded of tough plastics and powered with sturdy motors, rests upon efficient production-line methods

CAREFUL selection of molding materials, fidelity of proportion and detail, and efficient production-line manufacturing methods lie behind the steady growth of Product Miniature Co., Inc., Milwaukee, Wis., into one of the nation's major suppliers of self-powered, accurately scaled plastic models of actual passenger cars, motor trucks, tractors, cross-country busses, and other automotive vehicles that are being produced by leading manufacturers in the transportation field.[1]

In its two plants—one in Milwaukee and the other in suburban Pewaukee, Wis.—Product Miniature can turn out some 8500 model cars per day, a figure exceeding the output potential of the nation's largest automobile maker. This huge production capacity has been attained, without impairing product quality, through smooth integration of molding, decorating, assembly, and packaging operations. Currently, approximately 20 different models and model kits are offered by this company, ranging in retail price from $1.50 for most of the passenger car models and kits up to $35 for the electrically powered de luxe model Turn-Trac tractor, complete with transformer and remote control.

[1] See also "Precision in Miniatures," Modern Plastics *28*, 70 (May 1951).

Models Motorized

Although originally these models were distributed primarily through automotive and farm equipment dealers for promotional purposes, the present emphasis is upon sales through selected retail toy outlets. Also, whereas three years ago only the Turn-Trac model was motorized, most of the company's Tru Minia-

Body for Trailways Thru-Liner bus model is removed from 16-oz. injection machine. Windows are formed by side cores in mold

After body has been removed from mold, sprue is clipped preparatory to final decorating and assembly. Sprues are reground directly at machine

Courtesy Hercules Powder Co.

Representative of a line of motorized scale-model cars, marketed both in kits and fully assembled, are miniatures of the Corvette, a Nash four-door sedan, a Yellow Cab taxi, the Wienermobile, and a Trailways bus

ture models are now powered by efficient "Spin Torque"-geared flywheel motors which Product Miniature turns out in its own plant. These motors, which require no winding, propel the vehicles for long distances either forward or in reverse and greatly enhance their play appeal. Unlike wind-up type motors, they have no keys to lose and will last the life of the car. Another important contribution to increased realism is the adoption of transparent plastic window inserts for the passenger cars, replacing the opaque metal inserts used earlier. Some of these are molded of clear material and others are in transparent green to simulate anti-glare car windows.

Even small details of such parts as grilles, bumpers, head and tail lights, hood ornaments, and door handles are faithfully incorporated in the Product Miniature models. This emphasis on accuracy is made possible through the cooperation of automotive and farm implement manufacturers, who provide actual blueprints from which the models are carefully scaled. Since the manufacturers themselves must approve the finished models, very high standards are maintained as to fidelity of appearance when compared with the full-scale counterparts.

Tough Materials

Even the best looking model cars and trucks will not win the approval of buyers if they fail to stand up in shipment and in the hands of active youngsters. For this reason, Product Miniature confines its molding to plastics which are notable for their toughness, while offering a complete color range so that colors of the full-size equipment may be closely duplicated. Cellulose acetate and impact-type styrene are used in molding the Product Miniature car bodies and practically all other parts used in the construction of the models. For such specialized parts as gears for the electrically powered Turn-Trac model, molded nylon is now employed. Their performance is far superior to that of the metal gears.

Another important factor in the success of the Tru Miniature models is the fact that they are kept up-to-date to correspond with vehicles currently on the market. For example, two of the newest models in the line are the Chevrolet Corvette sports car, which went into commercial production early this year at Chevrolet's St. Louis plant, and the new Trailways "Thru-Liner" two-level bus, soon to appear on the nation's highways. In addition to its powerful dual-flywheel type motor, this model bus incorporates such added features as removable rubber-tired wheels, a dummy engine which mounts in the rear section of the vehicle, four miniature suitcases for the luggage compartment in the side of the bus, and a changeable destination sign listing the names of 16 major cities.

Measuring 18 in. long and 5 in.

Spray guns and metal spray masks are used for applying color to body of bus model. Trailways name along sides of bus, molded in relief, is tinted with stencil and roller

Color is applied to bucket seats and interior section of Corvette model with automatic spray unit

Courtesy Hercules Powder Co.

Courtesy Hercules Powder Co.

Plastic bodies and metal chassis of Corvette models are assembled and steering wheel and windshield cemented in place on line handling complete models and kits

On assembly line for Nash model, one side works on body shell, while the other handles chassis assembly

high, the new Trailways bus is the largest automotive model now being made by Product Miniature. The highly detailed body is molded of white high-impact styrene in a 3600-lb. mold on a 16-oz. H-P-M injection molding machine. Despite the size of the piece and the use of side cores in the mold to form the many windows in the bus body, it is produced on an 18-sec. molding cycle. The body is gated at two points on the top, via a heavy runner into which the sprue feeds near the center. Runners are clipped off by the press operator and reground directly at the press.

A four-stage decorating operation on the Trailways bus involves three paint spraying operations followed by roller and stencil application of color to the raised-letter name on both sides of the vehicle. Each stage of the painting process, carried out in adjoining spray booths, is facilitated by use of metal spray masks made in matching halves. Mounted on tables which are free to swivel horizontally, the masks close tightly around the bus body, actuated by air cylinders controlled by a foot pedal. Following application of each color, the masks are retracted and the body removed for a brief drying period before being put through the next stage of the decorating process.

Before the bus bodies leave the paint department, four small decals are also applied to the front, back, and sides, and the destination card holders are cemented in place against the roof of the bus, on the inside surface, so that the city names appear through a small window just above the windshield. This assembly consists of a small molded frame on which the black vinyl sleeve bearing the names of the cities is slipped. The reading may be easily changed by inserting a finger through the open windshield of the bus and sliding the vinyl sleeve to a new position.

Mounted on Chassis

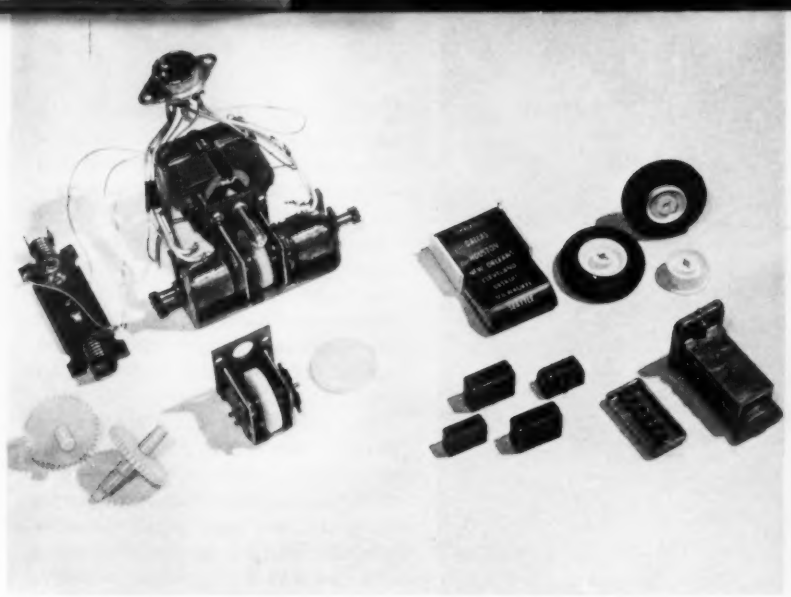
Following the painting operations, the bus bodies are transferred to the assembly line where they are mounted upon the sheet steel chassis on which the three axles and the Spin-Torque motor are mounted. The chassis is made with a channel around the outer edge into which the bottom of the plastic body is inserted.

The 10 wheels on the bus—double wheels on the two rear axles and single on the front—are molded with keyway-type slots so that they may be easily removed from and replaced upon the axles, which have short bars at the end that lock into shallow slots in the outside of the wheel hubs. Small coil springs on each axle exert outward pressure to keep wheels and axles engaged.

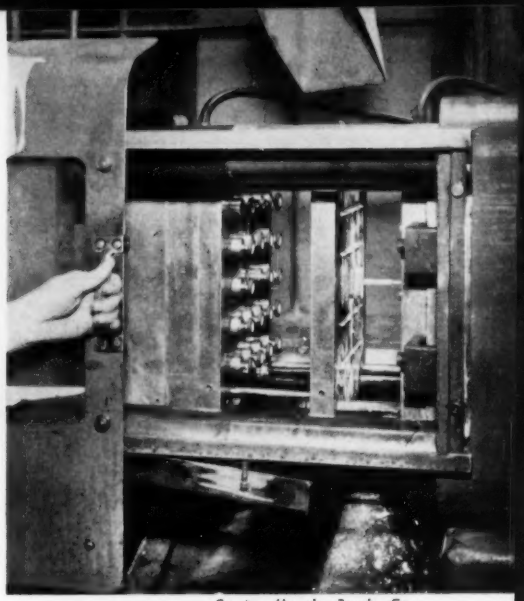
The body for the Chevrolet Corvette, like most of the other car bodies, is produced on an 8-oz. injection machine, using white cellulose acetate as the molding material. Before being placed on the "assembly line," the cockpit of the car is spray-lacquered in bright red to simulate the upholstery and trim of the actual Corvette. This operation is performed at high speeds on an automatic spray machine having two rotating turntables on which the bodies are clamped in an inverted position. When the operator presses the control switch, the body shells revolve and paint is automatically applied in an even coating to the interior of the car, covering the bucket seats, dashboard, and the inside surfaces of the doors, except for a narrow white strip separating the seats. In another mask and spray operation in a small spray booth, the headlights and front grille of the car are covered with metallic lacquer.

Kit Packaging

Like several other Product Miniature automotive models, the Corvette is sold both as a finished model and in the form of an assembly kit. Consequently, the Corvette line is set up to handle both types of production simultaneously. For the complete models, wheels are press-fitted onto the splined ends of the axles which are mounted on a sheet steel chassis. Bodies are then secured to the chassis by means of four thread-cutting screws which engage cored bosses in the underside of the body. As the cars move by conveyor



Electric motor and nylon gears for Turn-Trac are at left; at right are plastic destination card holder, tires, miniature suitcases, and dummy motor for Trailways bus



Courtesy Hercules Powder Co.

Wheels are injected directly into molded vinyl tires, saving a subsequent assembly operation

belt past the operators on both sides of the line, the steering wheel and wrap-around windshield are snapped into position and cemented.

For the Corvette kits, which are sold in a different-style package with the parts anchored to a die-cut platform, the metal chassis and motor unit and the molded acetate body are supplied unassembled. Also included in the kit are the four wheels, the steering wheel, and the curved windshield, along with small bottles of red and silver lacquer and a brush. The assembly screws and a decal insigne are supplied in a small envelope. Complete instructions for assembling and painting the model appear on the bottom of the display box for ready reference.

The assembly line for the 1954 Nash four-door sedan typifies the operations involved in producing many of the company's other models. A unique feature of the Nash is the fact that its chassis, as well as the body shell, is molded of cellulose acetate rather then being formed of sheet metal.

Approximately a dozen operators staff the Nash assembly line. At the beginning of the line, the plastic bodies enter the final assembly operation. At the moving conveyor which carries parts and sub-assemblies down the line, operators along one side concentrate on chassis assembly, while those opposite work on the body. The first step involves use of a multiple drill and fixture to drill holes in the plastic chassis for mounting the motor plate. In the next operation, the motor plate is fastened to the chassis with four rivets. Two operators utilizing fixtures equipped with air cylinders then press the wheels into place on the ends of the axles. Front and rear bumpers are riveted in position by another operator. As each phase of the work is completed, the sub-assembly is returned to the

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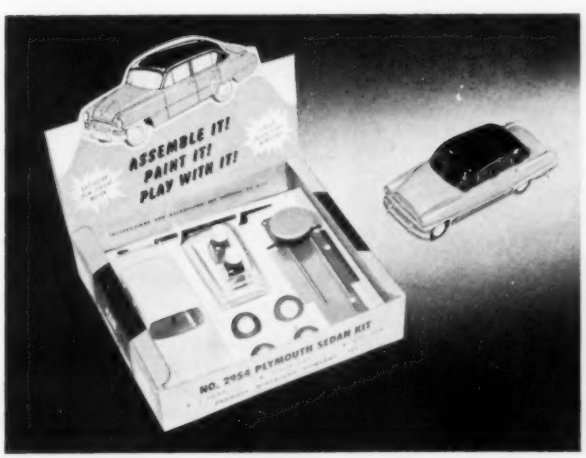
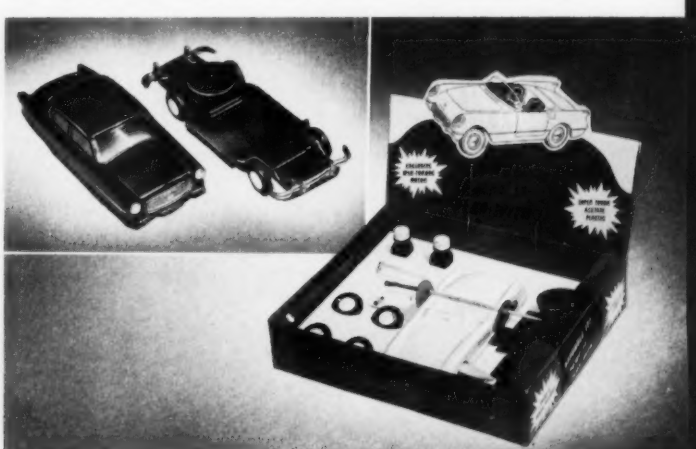
Plymouth sedan kit contains acetate body, motor, wheels, paint, and all other necessary parts for constructing the finished model



Corvette model (in kit) has cellulose acetate body and metal chassis; Nash sedan model (inset) has body and chassis molded of acetate



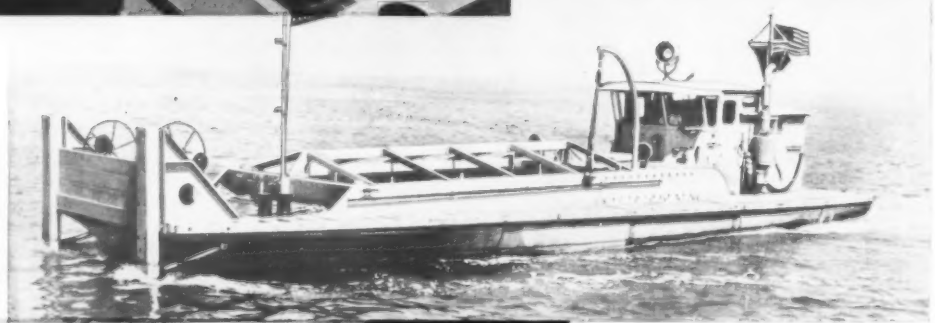
PLASTICS

STIMULATED by advances in plastics technology, sandwich constructions have today developed into engineering materials of importance to the aircraft, boat building, packaging, home construction, and related industries . . . and leaders in the design and application of sandwiches optimistically predict that there are still a large number of potential big-volume markets just waiting to be tapped.

The reasons for this optimism are obvious. Since it is recognized that developments in the field of synthetic resin adhesives during the past ten years have been largely responsible for perfecting sandwich constructions as we know them today, it is assumed, by the same token, that now the even newer adhesives, such as the epoxies and the polyure-

Courtesy United Merchants, Inc.

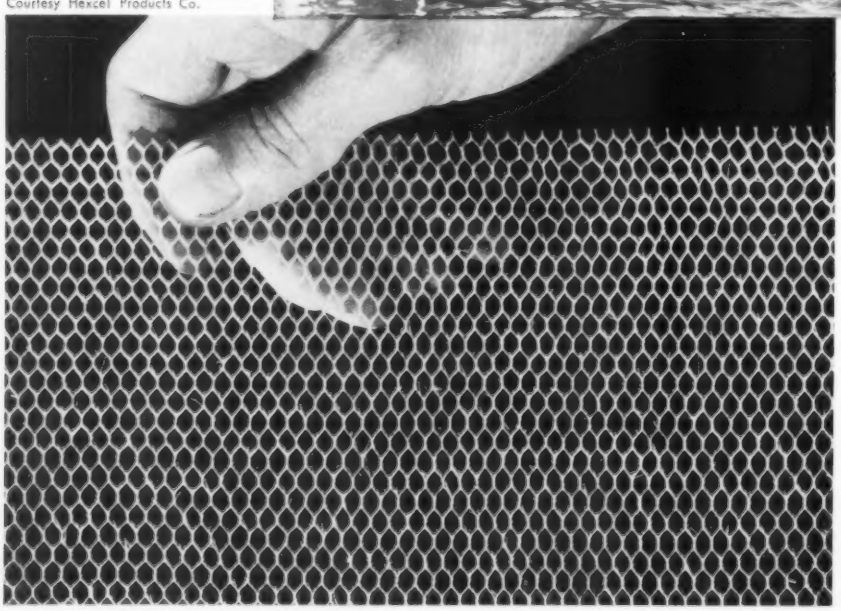
Entire hull of 50-ft. self-propelled barge, described as "the world's largest plastic craft," is made up of sandwich materials—reinforced plastics faces with a phenolic-impregnated cotton duck honeycomb core



Courtesy The Englander Co., Inc.

Lightweight, rugged sandwich construction of the hull makes the barge useful in very shallow inland waterways where heavier vessels have too great a draft to be of any value

Courtesy Hexcel Products Co.



High compressive strength typical of resin-impregnated honeycomb cores (a fibrous glass reinforced plastic core for aircraft sandwich radomes is shown at left) contributed to the success of the plastic barge (above)

thanes, will be equally as important in booming the materials to record new sales volumes.

At the same time, the availability of new plastics foam core materials that make it possible to produce effective sandwich constructions more quickly and economically than has heretofore been possible, is also contributing to a growing awareness on the part of industry of the many advantages inherent in the sandwich.

Basic Construction

Sandwiches are defined as composite panels consisting of several alternate layers of similar or dissimilar materials bonded together with an adhesive. As such, they contain three basic elements: 1) two thin high-strength faces designed to carry the major applied loads; 2) a relatively thick, low-density core material between the two faces; and 3) a bonding medium which effectively fixes the faces to the core.

Despite the simplicity of sandwich construction, however, the material is an extremely versatile tool. Since a diverse line of materials can be used either as face or core, the number of combinations which can be produced in sandwich construction form to meet the specialized needs of industry runs well into the hundreds—and in virtually every one plastics materials have an important role to play.

Facing Materials

Theoretically, almost any type of sheet material can be used for the outer faces of the sandwich and practically every kind has been tried at one time or another. Originally, most sandwich facing materials were wood, but the list has now been lengthened to include plastics, metal, and even glass. The decision as to which one to use must be based on the strength, weight, stiffness, and maintenance requirements of the particular application for which the sandwich is intended.

From the standpoint of plastics use, reinforced plastics materials are by far the most important type of facing. As the reinforcing agent in the majority of applications, particularly where excellent dielectric characteristics, low moisture absorption, strength, light weight, and adaptability to compound curvatures are required, fibrous glass is used. For non-structural applications, such as flooring, partitions, table tops, and baggage racks, resin-impregnated paper and cotton duck are available.

Thermosetting resins, particularly polyester, phenolic, melamine, and urea resins, are most in use as the impregnating material. Resorcinols and alkyds are employed in smaller quantities.

Attention recently has also focused on the possibilities of the epoxies and the fluorocarbons as impregnating resins. Poly-Plastics Div. of REF Mfg. Corp., Mineola, N. Y., for example, reports excellent success with the use of a sandwich material consisting of an epoxy-impregnated fibrous glass cloth face over a cellular cellulose acetate core in the design of an airlines food tray carrier. The carrier is light in weight, leakproof, and strong enough to stand up under the repeated use and hard service to which it is customarily subjected. The company also reports that this type of sandwich construction is believed adaptable to the refrigeration and food handling fields.

The fluorocarbon sandwich face consists of a 10-mil film of Kel-F fluorocarbon laminated to the top surface of a fibrous glass cloth. Although this facing material is still in an experimental stage, The M. W. Kellogg Co., Jersey City, N. J., suppliers of the Kel-F, feel that the outstanding service qualities of the fluorocarbons will contribute much to the eventual expansion of sandwich constructions into a number of specialized applications.

Metal facings, for use where exceptionally high structural strength

MAKE THE SANDWICH

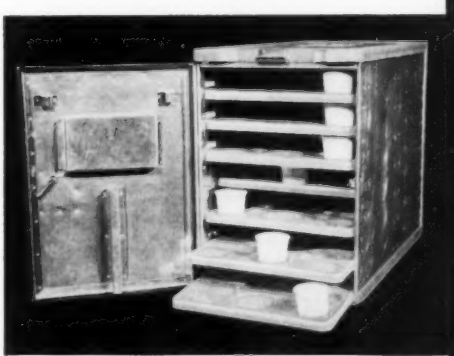
Developments in the use of plastics for facing, core, or adhesive help create important new markets for sandwich materials

Courtesy Bakelite Co.

Boat deck is made by facing impregnated honeycomb with reinforced plastics

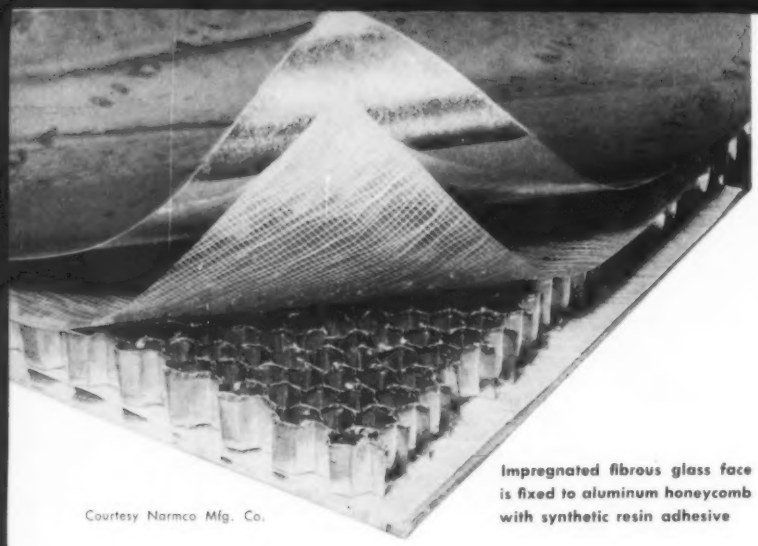
Courtesy Bakelite Co.

Phenolic resins increase strength of paper core used in building panels



Courtesy Skydyne, Inc.

Sandwich-walled airlines food carrier is uniformly insulated throughout



Courtesy Narmco Mfg. Co.

Impregnated fibrous glass face is fixed to aluminum honeycomb with synthetic resin adhesive

is required, include aluminum, magnesium, steel, and titanium sheets.

Newest addition to the family of facings is sheet glass. Made possible by developments in epoxy and polyester adhesives, the use of glass as a facing material in sandwich construction is still the subject of research, and many in the industry feel that it is much too new to determine exactly how it is going to fare in the market. Using aluminum honeycomb supplied by Hexcel Products Co., Div. of California Reinforced Plastics Co., Oakland, Calif., as the core, the new product, called Hexcelite, will be fabricated by franchised dealers of Hexcel for use in doors, table tops, and other interior uses. Research has also been conducted on the possibilities of using acrylic sheets as the facing material instead of glass.

Low-Density Cores

Plastics also play a leading role in the formulation of the core materials which are designed to simultaneously separate the two outer facings of the sandwich, to support the faces, and to transmit stresses while retaining definite weight advantages.

The use of plastics in core materials takes two forms: 1) as the impregnating resin for paper, glass, or cotton duck honeycomb open-cell cores; and 2) as cellular foam materials, either prefabricated or foamed-in-place.

Honeycombs are generally used in preference to foams, where higher compressive strength is a factor. Paper honeycombs, which are used in semi-structural sandwich panels where light weight, good insulating properties, and low cost are desirable, are impregnated with resin, usually phenolic, to improve their wet strength, low moisture absorption properties, and resistance to environmental factors.

Cotton cloth honeycomb cores are also impregnated with resin, again generally phenolic, to improve compressive strength and resistance to moisture. These cores are used in secondary structure sandwich panels such as partitions, bulkheads, and baggage racks.

Finally, the polyester or epoxy resin-impregnated fibrous glass honeycombs are designed to offer the same advantages as the facings made out of the material—strength, rigidity, excellent dielectric properties, light weight, and low moisture absorption properties.

Foamed Cores

The newest type of core materials, and certainly one of the most exciting to come along in years, are the foamed plastics. These foams are available to the manufacturer of sandwich panels either as solid blocks or sheets of cured cellular material which can be cut to size and fit into the open cavity or as liquid, foamed-in-place resins that are poured into place between two preformed facing sheets where they expand to fill the cavity and are then self-cured. (See "Three New Foams," MODERN PLASTICS *30*, 85, April 53).

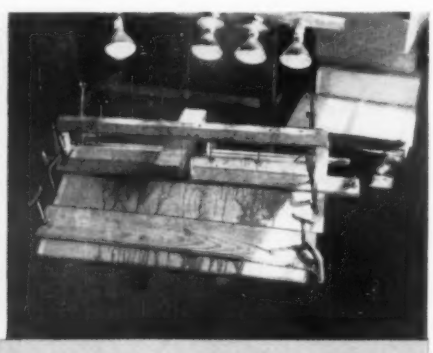
Foam in block form is available from companies such as The Dow Chemical Co., suppliers of Styrofoam expanded styrene, and Strux Corp., Lindenhurst, N. Y., suppliers of Strux cellular cellulose acetate. The Colton Chemical Co., Cleveland, Ohio, supplies an expanded urea formaldehyde material in block or shredded form.

Several different types of foamed-in-place resins are also available. Among these, three that have been attracting a great deal of attention in recent days are phenolic, isocyanate-based, and silicone foams. Gen-

Photos courtesy Emerson & Cuming, Inc.

1 **In production of cable depressor (see text, p. 215), metal structure is placed over mold**

2 **Polyester resin is foamed around structure and assembly removed from mold**



3 **After foam core is faced with polyester-fibrous glass laminate, lay-up is cured**

eral Electric Co., Chemical Div., Pittsfield, Mass., and Westinghouse Electric Corp., Pittsburgh, Pa., are suppliers of a self-expanded phenolic foam characterized by excellent buoyancy, thermal and acoustical insulating properties, and resiliency.

The isocyanate-based foams have already created quite a stir in this country. American Latex Products Corp., Hawthorne, Calif.; Armour and Co., Chicago, Ill.; Emerson & Cuming, Inc., Canton, Mass.; Goodyear Aircraft Corp., Akron, Ohio; Isocyanate Products, Inc., Wilmington, Del.; Lockheed Aircraft Corp., Burbank, Calif.; and Nopco Chemical Co., Harrison, N. J., have been active in the field for some time now.

E. I. du Pont de Nemours & Co., Inc., a supplier of isocyanates who licenses companies to produce a diisocyanate foam using its materials, has also been experimenting with the foam in a variety of sandwich constructions.

One variation of the isocyanate-based foams that manufacturers are predicting will have an important effect on sandwich construction in the future is the isocyanate-polyester or polyurethane foam. According to Mobay Chemical Co., who will produce isocyanates for a polyurethane foam, this new material has exceptional thermal insulating advantages, is light in weight but structurally strong, exhibits excellent adhesive qualities when being foamed in place in the sandwich, is low in water absorption, and has relatively good dielectric characteristics.

A silicone foam, which is available either as a cast sheet or as a foamed-in-place preparation, is supplied by Dow Corning Corp., Midland, Mich., and is characterized by exceptional heat stability and resistance to thermal shock, serviceability at elevated temperatures, good physical, chemical, and insulating properties, and low water absorption properties.

Plastics also play a role in another type of core material—wood waste fibers bonded together with a thermosetting resin such as phenolic. Bartrev Board, produced by Bartrev Ltd., London, England, is one example. This resin-impregnated wood waste material can be faced on either side with plywood or decorative high-pressure laminates to create a low-cost, lightweight, and strong sandwich construction for building, partitioning, linings, and furniture applications.

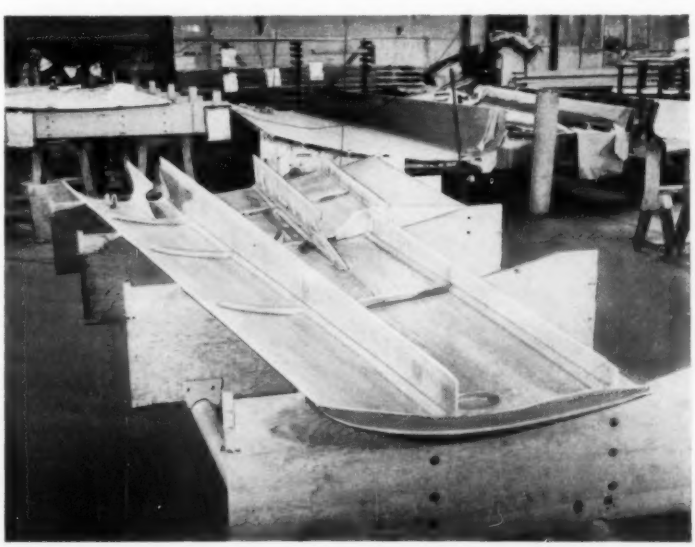
Among the non-plastic cores are metal and glass honeycomb and balsa wood. The latter material, in particular, has attracted a great deal of attention as a possible core material to be inserted between resin-fibrous glass laminate faces. The first step in this direction was taken by Insulation Assoc., Inc., Fanwood, N. J., in the design of a milk truck tank that boasted lighter weight and better thermal insulation properties than the standard reinforced plastic construction (see " 'Sandwich' Walls for Milk Tank," MODERN PLASTICS *31*, 87, Feb. 1954). And International Balsa Corp., Jersey City, N. J., a supplier of the wood, claims to be in the process of developing other truck tanks, shipping containers, insulated ice cream containers, and various consumer products based on the same type of construction.

Adhesives

It is in the formulation of bonding adhesives that plastics have contributed most to the development of sandwich construction. Prior to the introduction of synthetic resin adhesives, wood-to-wood laminations were virtually the only type of sandwich construction possible. With the development of synthetic resin adhesives (see "Adhesives Advance," MODERN PLASTICS, *31*, 93, Dec. 1953), however, the picture changed radically. By enabling plastics, metal, wood, paper, and glass materials to be permanently bonded to themselves as well as to each other, the resin adhesives opened new doors of opportunity for sandwich constructions. Today, the introduction of epoxy and polyurethane resin adhesives has increased the market potential of sandwiches even more. Both resin adhesives exhibit permanent, waterproof bonds in the sandwich and may be prepared so that curing at room temperatures is possible.

The number of resins, in addition to the epoxies and polyurethanes, that go into the formulation of adhesives for sandwich constructions are enormous. Most of these bonding materials are based on thermosetting resins, with phenolic leading the pack. Other popular formulations are

Photos courtesy East Coast Aeronautics, Inc.



Core of airplane wing shell (below) consists of cellular cellulose acetate pieces wrapped in fibrous glass cloth (above); faces are polyester-fibrous glass laminates

those based on silicones, furane-derivatives, and resorcinol.

Among the newer adhesives still in the development stage is a modified vinyl-phenolic resin created by E. L. Cournand & Co., Inc., Havre de Grace, Md., to double in a sandwich construction as a laminating resin for the fibrous glass cloth face and as an adhesive to bond the face to the core.

Characteristics

The basic design of the sandwich construction—two relatively thin faces separated by a thick core—is intended to create a panel with three characteristics: rigidity, strength, and light weight. The diverse range of materials which can be used for any of the components of the sandwich, however, makes it possible to vary the load-bearing capabilities of the construction widely. At the same time, materials can be selected to emphasize such end-use requirements as thermal insulation, vibration dampening, resistance to moisture, attractiveness, or whatever other physical, chemical, or electrical properties might be desired.

Haskelite Mfg. Corp., Grand Rapids, Mich., for example, was faced with the problem of creating a sandwich construction to meet five basic requirements: 1) structural strength combined with light weight; 2) low thermal conductivity and constant insulating values; 3) resistance to moisture, vermin, impact, and deformation; 4) elimination of corrosion and rot; and 5) integral surface finish. By combining the strength, light weight, and corrosion resistance of a pigmented polyester resin-fibrous glass laminate face with the light weight and insulation values of a Styrofoam expanded styrene core, the problem was effectively solved in a single sandwich construction.

Applications

With such diversity at their finger tips, the manufacturers of sandwich materials are constantly experimenting with the application of their products in many markets. At present, interest seems to be centered in five fields: 1) aircraft; 2) surface and water transportation; 3) packaging; 4) building construction, including housing, portable shelter units, walk-in-type freezers, etc.; and 5) miscellaneous industrial and consumer items, such as drawing boards, scaffolds, ladders, pallets, furniture, and related products.

It is in the aircraft field that sandwich constructions, primarily those with reinforced plastics faces, have found their biggest market.

Basically, sandwich constructions answer the aircraft industry's demands for smooth-faced, stiff structures to meet the arduous problems imposed by ever-increasing aircraft speeds. High strength with minimum weight and maximum rigidity, radar transmission characteristics, and resistance, in many cases, to impact and gun blast, are the primary advantage of the sandwich in aircraft design.

In addition, the ease of working with the new sandwich core materials, whether they be honeycombs (see "New Techniques in Fabricating Honeycombs," MODERN PLASTICS, *31*, 101, Feb. 1954) or foamed-in-place plastics, has meant a greal deal in production costs savings to the aircraft industry. Narmco Mfg. Co., San Diego, Calif., for example, conveniently fabricates its reinforced plastic-honeycomb sandwiches in contoured shapes, such as rudder and stabilizer trailing edge sections and primary structure wing tips, which can be easily installed.

Stinger Tail

One outstanding example of the adaptation of sandwich construction to aircraft is the stinger tail of the Navy's Neptune patrol bomber which Zenith Plastics Co., Gardena, Calif., is making with a reinforced plastic honeycomb core and reinforced plastics faces. According to Zenith, the use of sandwich construction for this application cut the number of engineering man-hours required for the job to ⅛ as many as would have been necessary for an equivalent metal structure. Again in comparison to the production of a metal unit, only ½ the factory floor space and ⅛ the production manpower was put to use. The finished pieces are about ⅔ the weight of the lightest practical metal equivalent and are impervious to extreme climatic and environmental conditions. The tail is molded in five sections using metal sprayed molds backed up by sheets of glass cloth impregnated with polyester resins supplied by Bakelite Co.

In another outstanding aircraft application, an experimental wing which has already successfully completed approximately 1000 hr. of preliminary flight tests at the Air Research and Development Command's Wright Air Development Center, Dayton, Ohio, has been constructed for the U. S. Air Force by East Coast Aeronautics, Inc., Pelham Manor, N. Y., a subsidiary of Barium Steel Corp.

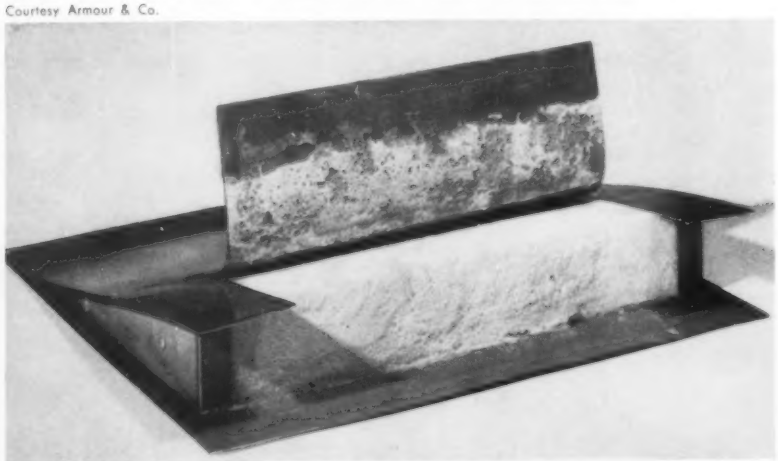
The core of this wing is cellular cellulose acetate; the outer faces are polyester resin-fibrous glass laminate, ranging in thickness from 7- to 40-ply, depending upon the load to be encountered on the various wing areas.

It is interesting to note that com-

(*To page* 215)

Foamed-in-place isocyanate-based core material is supplied as a liquid that is poured into the airplane wing where it expands to fill the entire cavity and self-cures

Courtesy Armour & Co.



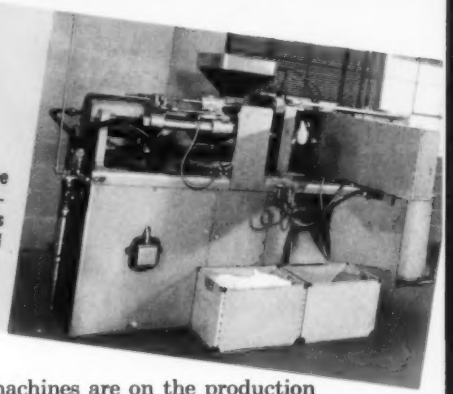
NEWS AND VIEWS OF PLASTICS PROGRESS

STOKES plastics review

VOL. 3
NO. 4
1954

PUBLISHED BY F. J. STOKES MACHINE COMPANY, PHILADELPHIA 20, PA.

General Electric Selects Stokes Automatic Injection Molding Machines



Close-up of one of three Stokes truly automatic injection molding machines in General Electric's Small Appliance plant at Brockport, N. Y.

Truly automatic injection molding of finished de-gated pieces ready for packaging or assembly was announced to the industry by Stokes at the Plastics Show last June. The Stokes 4-ounce machine unveiled to public view at that time, aroused—and has continued to arouse—a remarkable degree of interest.

However, the machine was "new" only in the sense that its existence was not generally known. A considerable number of these machines have been steadily in service on the production line over a period of three years. They have proved themselves highly efficient, fully reliable, versatile in application, and capable of reducing labor cost per piece to a point at which labor is virtually not a factor in production.

Prominent among users is General Electric Company's Small Appliance Division at Brockport, N. Y. Here, three of the Stokes truly automatic injection molding machines are on the production line for the manufacture of General Electric's popular fruit juicer. One makes the strainers, one makes the collectors—each on a 40-second cycle—and the other makes the handles in a two-cavity mold on a 68-second cycle.

An attractive folder on the Stokes truly automatic injection molding machine shows graphic sequence pictures of the seven phases in the molding cycle. Use the enclosed card.

Mid-Western Paint & Varnish Company is Leader in Vacuum Metallizing Techniques

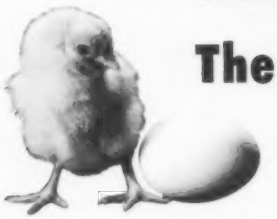
Red Spot Paint & Varnish Co., Inc. of Evansville, Indiana, is a 50-year-old veteran in supplying conventional brush coatings for the mid-west area. Evidence of the energy which has characterized the company's growth has been its expansion into the resin finish field, establishment of branch plants in Illinois, Mississippi and Kentucky, and early venture into the study and production of many types of coatings for use in vacuum metallizing.

Not the type to do things by halves, nor yet to accept specifications of others, Red Spot set up a fully equipped laboratory for study of the vacuum metallizing process and the lacquers needed for topcoats, undercoats, etc. The equipment consists of paint spray and dipping equipment, baking ovens for infra-red or convection drying, a Stokes vacuum metallizer, dyeing equipment for coloring of topcoats, and humidity, salt-spray and other testing equipment. Here, the firm's technical staff makes test runs on a great variety of plastic, metal, and other samples sent by manufacturers and custom metallizers throughout the country. Final reports are supplied on first-surface or second-surface coatings, lacquer undercoats and topcoats, time cycles for metallizing, and engineering of racks for handling pieces in the various operations.

Stokes Vacuum Metallizer, Model 425, for laboratory or small production use, in laboratories of Red Spot Paint & Varnish Co., Inc., Evansville, Indiana. Stokes Vacuum Pump in background.

Red Spot, one of the first companies to see the importance of vacuum metallizing as a finishing process, is credited with having devised the technique of second-surface coating. The company has also published an informative glossary of the technical terms used in vacuum metallizing.

An interesting and richly illustrated presentation of the vacuum metallizing process is available in a recent brochure which can be requested on the enclosed card.



Which Came First, The Chicken or the Egg?

Sometimes it seems difficult to tell whether prices of manufactured goods go up because labor costs go up, or labor costs go up because prices have gone up. But this question becomes academic when the buyer asserts his rights and says, "It costs too much; I won't buy it!" The point is often overlooked though Adam Smith stated it clearly in "Wealth of Nations," sometime before 1800, when he said, "In the long run the buyer determines the price of the product regardless of what it costs to make it."

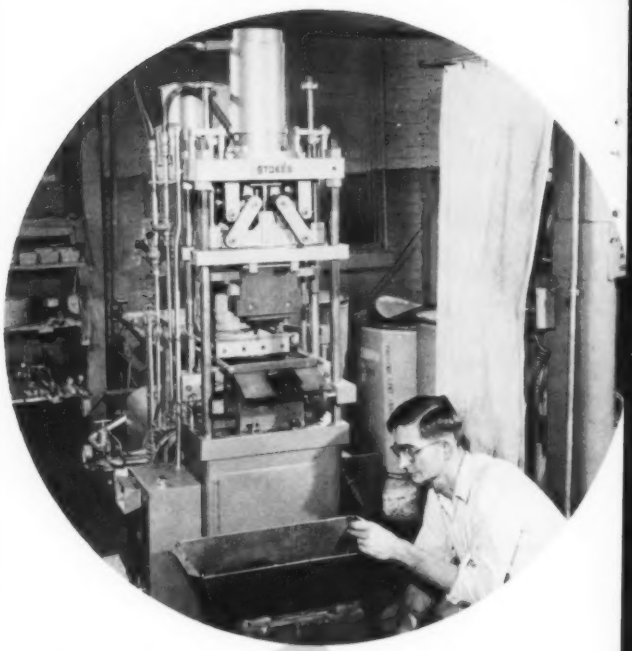
So we in the plastics business are now in a buyer's market. If we are buying our materials at the best possible price, and paying labor a fair wage, and the market is paying the most we believe it is willing to pay for our products, what do we do to maintain price levels and profit levels in the face of rising labor costs?

We believe that the Plastics Industry, like the automotive and electronic and many other industries, must make more generous use of automatic machinery. With automation comes greater productivity per man employed; hence lower labor cost per unit of goods produced. This means new equipment and substantial investment, but it does not appear that the need for investment has ever stood long as an impediment to the profits to be derived from new equipment. Indeed, this situation is a major goal of investment money.

Many of the thousands of semi-automatic presses in use in this country could practically and profitably be replaced with fully automatic compression molding presses. For most semi-automatic presses there is one workman in attendance; as many as three men daily if the press is running continuously. Replaced with fully automatics, each would require only a fraction of a man's time. In fact, 10 or 12 or more fully automatic presses are a normal assignment for one man. Fully automatic equipment, both compression and injection, has been tested in years of service. Its ability to produce at far less unit cost can be demonstrated by a study of the part to determine production cost.

To be sure, many complex parts or parts with inserts cannot successfully be made on fully automatic presses. But experience has shown that many other parts are made in a certain way only because someone is in the habit of making them that way. It is amazing how objective redesigning will often adapt a part to fully automatic production and open the road to greatly reduced costs. Often, we have found, redesign with this primary objective alone has resulted in a part which is actually better than the original.

But that is beside the point. The big question is: Can you afford not to have new fully automatic equipment if it will assure you reductions in manufacturing costs and protection of your competitive position?



Operator at Hetherington, Inc., Sharon Hill, Pa., spot-checks electronic components in production on Stokes fully automatic Model 800. The press is working with a 12-cavity mold on a one-minute cycle.

Leading Switch Manufacturer Modernizing with Stokes Fully Automatic Presses

Just in time to be well organized before World War II, Hetherington, Incorporated started its electrical switch manufacturing business at Sharon Hill, Pa. During World War II and the more recent Korean conflict Hetherington became a major supplier to the Armed Forces.

Switches, relays and other electrical and electronic components are the bulk of the company's products. These are internally designed to meet customers' needs, or manufactured to customers' specifications. All major aircraft companies, as well as Armed Forces, are current outlets for the company's products.

The Stokes Model 800 shown in the illustration above is a fully automatic press of 15-ton capacity. It is making an electronic component in a 12-cavity mold on a one-minute cycle, at the rate of 720 pieces per hour. Hetherington is a long-time user of Stokes presses of which the Model 800 is the latest. The trend to modernizing production methods by changing to fully automatic presses is spreading widely in the custom molding business.

Hetherington, Incorporated has a branch plant at Culver City, California, and recently announced establishment of a new branch at Richardson Park, Delaware.

The Wonders of Modern Science!

It's a far cry from the old kitchen coal stove, about half the size of a Ford coupe, to a modern electric cooker. But science has made the leap! Supply Sales Co. of Long Island City, N. Y., makes a "Roto-Broil Custom 400" that staggers the imagination of the average housewife or weekend chef.

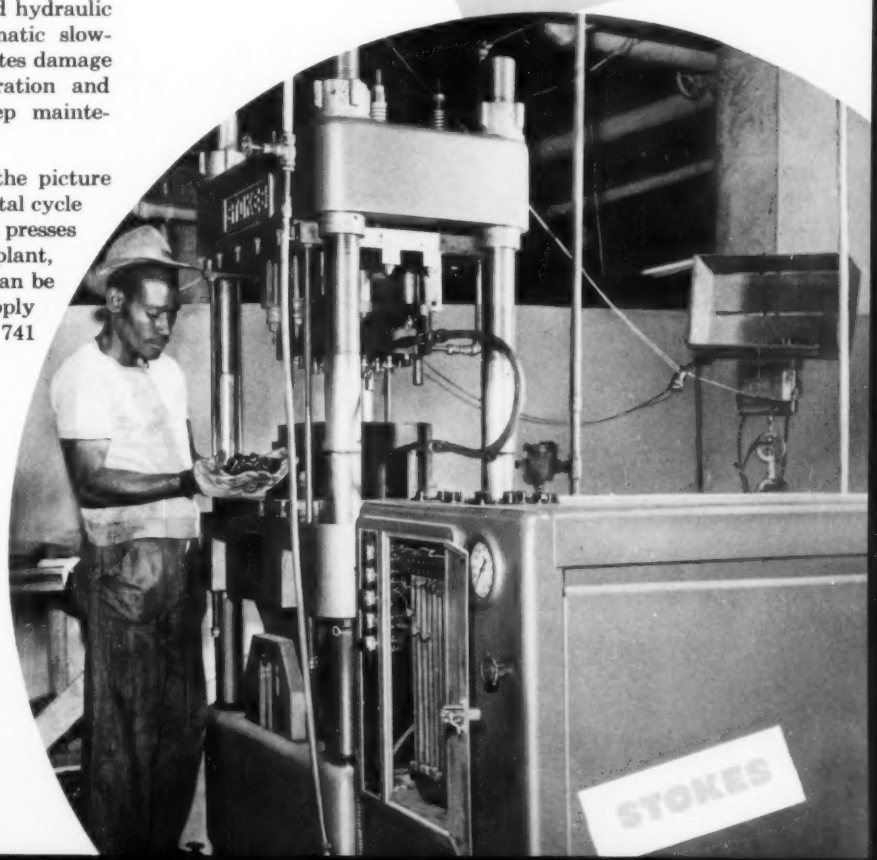
The Roto-Broil 400 barbecues, roasts, broils, grills, fries, toasts, boils and bakes. The barbecue motor can be shut off when other activities are afoot. What's more, you can even see the stuff cooking! A patented baking unit can also be used as a hot table tray, cold serving tray, or as a cooking grill apart from the broiler. You still must eat the food yourself.

The Roto-Broil is basically a stainless steel stove with elaborate heating and timing mechanisms, all under simple pushbutton control. It is furnished with a variety of knobs and handles made on Stokes 150-ton semi-automatic presses.

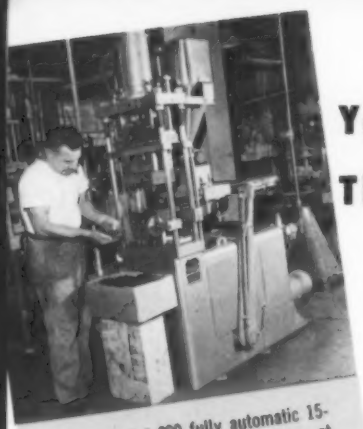
Supply Sales Co., experienced hands at plastic molding, have ample background for judging the superiority of the Stokes Model 731 semi-automatic toggle press. Three of the Stokes 731 presses have been shipped to Supply Sales Co. and others have been ordered. The user is reported to be extremely pleased with the high-speed initial closing and automatic slow-down at final closing, which are characteristic features of the toggle and hydraulic design of the new 731 presses. Automatic slow-down minimizes mold wear and eliminates damage to delicate molds. Low-pressure operation and seamless steel tubing throughout keep maintenance below normal levels.

Control knobs such as those seen in the picture above are run in a 9-cavity mold on a total cycle of 2½ minutes. The model 731 molding presses such as those used in the Supply Sales plant, are fully described in a bulletin which can be requested on the enclosed postcard. Supply Sales Co. also uses two Stokes Model 741 fully automatic presses for several years, often running 24 hours a day, virtually without attention.

The Roto-Broil Custom 400, a highly versatile cooker operated by pushbutton control. Thousands of knobs and handles for the Roto-Broil Cooker are made on Stokes Model 731 semi-automatic presses.



General view of one of the Stokes Model 731 semi-automatic 150-ton toggle presses at Supply Sales Co., Long Island City, N. Y. Open control cabinet at right shows the patented Stokes Bar Controller which gives precise and automatic control of the molding cycle. It is an advantage that the positions of the central knobs can be recorded and duplicated whenever the same piece and same material are used.



Stokes Model 800 fully automatic 15-ton compression molding press at Mechanical Institute, Boonton, N. J., one of 9 fully automatic Stokes presses in this plant.

Close-up of a magneto block as it comes from the mold of a Stokes Model 726 semi-automatic molding press.

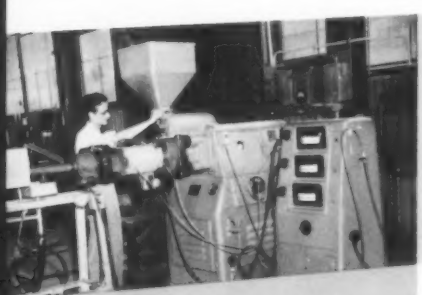
You've Got to be Right when Making These Magneto Blocks for Aircraft!

These big magneto blocks with knobs, ridges, pins and posts galore are made to strict specifications for aircraft engines by Mechanical Institute of Boonton, N. J.

The Stokes Model 726 straight ram press forms the blocks on a schedule of 24 hours a day, 5 days a week. A valuable time-saving feature in the tooling devised by the customer is that as the press opens, the clamps and jigs dismantle a great part of the mold and reduce handling time, a complete hand operation on an earlier press. The press has been in use for ten months and is reported to be highly satisfactory in operation. This is one of nine Stokes semi-automatic presses in use at Mechanical Institute, six of them 50-ton presses and three of the 200-ton size.

Stokes *fully* automatic presses are represented by another group of nine, of which six are 50-ton presses and three 15-ton, the latter including a Model 800, a fast press ideally suited for making knobs, appliance parts, tube sockets, plugs and other parts of either simple or complex design. A shuttle feed supplies multiple rows of cavities of which there may be any number within the 15-ton capacity of the press. At Mechanical Institute the Model 800 shown in an adjacent picture is running a 16-cavity mold making bases for radio tubes at one cycle per minute. One man handles seven of the automatic presses, replacing a previous operation which required one man to a machine.

Mechanical Institute was established as a custom molding shop in 1941 by Messrs. F. K. Weiss, Sr. and Jr. It now employs over 50 operators and makes tools and dies in its own shop. Production is largely for the radio, TV and aircraft industries.



One of several Stokes-Windsor Extruders making rigid PVC pipe of various sizes at Easton Plastic Products Co., Inc., Easton, Pa. This modern plant is 200 by 100 feet in area. All electrical conduits, overhead and in concrete floor, are rigid PVC.

Four 20-foot lengths of 2-inch rigid PVC made by Easton Plastic Products Co., Inc., are easily supported by a girl. Note ingenious pipe storage racks. Extended sides can be loaded and unloaded from end or sides.

Easton Plastic Products Plant Makes and Uses Rigid PVC Pipe

The modern plant of Easton Plastic Products Co., at Easton, Pa., is entirely furnished with rigid PVC conduit, both as overhead electrical leads and those poured in concrete. For this purpose it is considered superior to the conventional metal conduit. Aside from its capacity to meet normal standards of mechanical strength and heat resistance, rigid PVC offers two unique advantages directly related to the installation of the electrical system. First, it is simple to bend by hand, requiring only brief treatment with a hot-air gun. Second, the surface is so smooth that wires are pushed or drawn through it with a minimum of effort. These advantages naturally reduce time required for installation.

Easton Plastic Products is using three Stokes-Windsor Extruders in its handsome new plant at Easton, Pa., to supply the growing demand for rigid PVC pipe. Space is available for a large number of additional machines to provide for imminent expansion to meet growing demand. B. F. Goodrich 8700A and 8750 are the materials chiefly used. Pipe sizes up to 4 inches diameter are in production; 6-inch and larger sizes planned. Harvey G. Wismer, Plant Superintendent, expresses complete satisfaction with the operation of his Stokes-Windsor Extruders.

Mr. Wismer states that rigid PVC is winning wide acceptance in European countries. In Holland, for example, building authorities have made exhaustive tests of plastic pipe and given approval for many common uses. A European affiliate of Easton Plastic Products Co., is now marketing over 6000 pounds per week of rigid PVC pipe for electrical conduits. There are interesting folders on rigid PVC and Stokes-Windsor Extruders which will be sent on request.

STOKES

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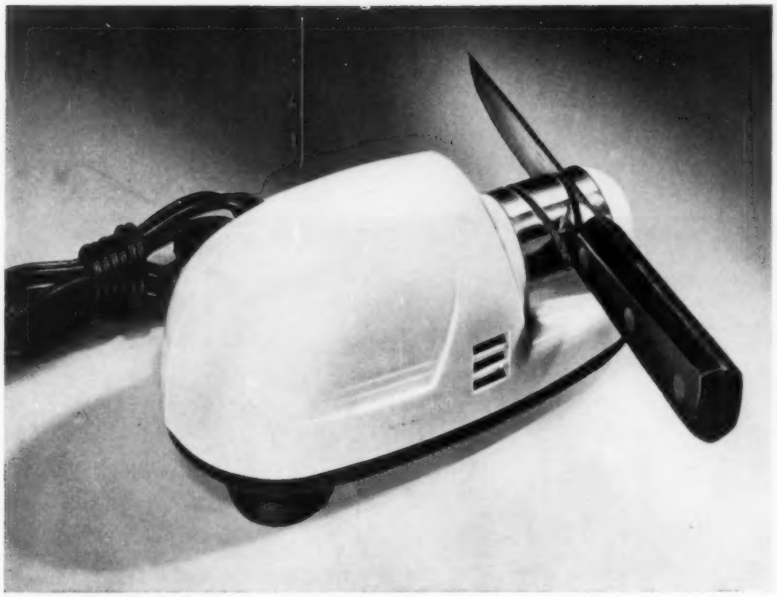
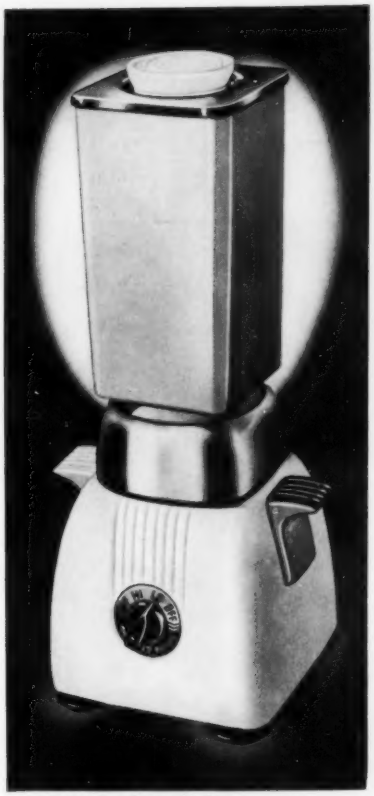


Courtesy McGraw Electric Co.
Housing of electric knife sharpener is molded of snow-white urea, has no corners or crevices to trap dirt. Molded-in ventilating louvers serve to keep powerful motor from overheating



Courtesy American Cyanamid Co.
Mixing container of food blender is molded of alpha-cellulose-filled melamine

THERMOSETS in Appliances

Heat resistance, good color range, and light weight were reasons for using melamine and urea

THREE attractive household appliances recently introduced by Manning-Bowman Div., McGraw Electric Co., Elgin, Ill., make effective use of the color range, heat resistance, durability, light weight, and dimensional stability of molded urea and molded melamine parts.

Two of the appliances—a rotary knife sharpener and a hand vibrator for massaging body or scalp—have molded urea housings. The third—a food and beverage blender—features a lightweight mixing container molded of melamine.

The housing for the knife sharpener, molded in snow-white Beetle urea, is styled in a modern contoured shape with no corners or crevices to trap dirt. The chrome-plated metal guard-guide which holds cutlery at the correct angle for sharpening is mounted in a recess in the front of the housing and is removable when the device is to be used for sharpening tools or scissors.

Three suction cups fastened to the base of the housing hold it firmly in place on any smooth surface, and molded-in ventilating louvers in the sides of the housing help to keep the powerful electric motor from overheating. The hard surface of the molded urea housing will not nick or scratch in normal use and is easily kept clean by wiping with a damp cloth.

The vibrator housing is also molded of Beetle urea in crystal,

(*To page 220*)

Courtesy McGraw Electric Co.
Vibrator with urea housing is packaged in molded urea case with styrene cover

CEILINGS OF

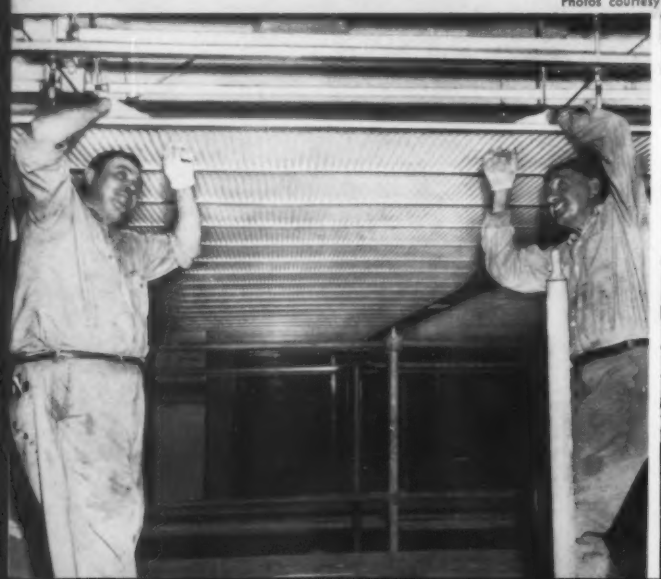
Courtesy Ezra Stoller

Plastic sub-ceiling made up of translucent corrugated vinyl diffusing panels installed below fluorescent lamps provides shadowless illumination, freedom from glare, and high light level with low source brightness for first four floors of an ultra-modern bank building

The easily installed vinyl diffusers are supported on a grid of aluminum T-bars suspended from the true ceiling by steel straps

Corrugations in the flexible vinyl sheets make the panels strong enough to span relatively large open areas with minimum support

Photos courtesy Marlux Corp.



LIGHT

An efficient new lighting system is designed around the use of diffusing panels formed from sheets of vinyl or acrylic

DESCRIBED by lighting engineers as "the closest approach to *perfect* illumination yet devised," a new lighting system based on the use of translucent plastics sheets has boomed within the past five years from an experimental architectural innovation to a major market whose consumption of plastics sheets already runs well into the millions of square feet per annum.

The new system makes use of a series of diffusing panels fabricated from vinyl or acrylic sheets. These panels — generally either corrugated or formed with a three-dimensional raised pattern — are ganged end-to-end, mounted in a single metal framework, and hung by a suspension system a few feet below the true ceiling.

Major Markets

Despite its relatively recent introduction to the lighting field, however, the new system is already playing a leading role in the modernization and building plans of manufacturing plants, institutional buildings, and sales offices. In one recent single application, for example, involving the construction of a new engineering building for a major aircraft company, more than 110,000 sq. ft. of acrylic went into the diffusing panels for the ceiling.

It is estimated by one of the manufacturers of the lighting system that more than 5 million sq. ft. of vinyl alone have already been installed as diffusing panels during the past five years and that approximately 4 million more sq. ft. of the plastic are on order for projected installations.

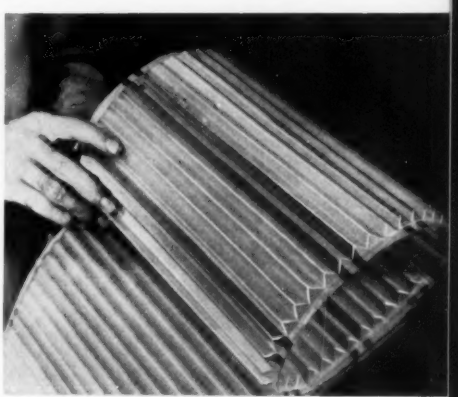
From the standpoint of lighting efficiency, the new system has much to its credit. Since the light sources, which are usually continuous runs of fluorescent lamps spaced at predetermined intervals, are located above the plastic sub-ceiling, light from these fixtures reflects back and forth between the plastic ceiling and the brightly painted structural ceiling until nearly all of it passes through the plastic.

In effect, the expanse of plastics diffusing panels thus becomes a single lighting fixture as big as the room. Light is diffused completely through the plastic and evenly distributed throughout the room without shadows or glare. At the same time, a high intensity of light reaches the working surfaces. Most installations are designed for a minimum of 50 footcandles—more than ample for normal routine—and there are many that have gone as high as 240 footcandles. Similar light intensities from conventional overhead lighting fixtures would probably result in direct glare reflection, high specular reflection off glossy surfaces, and consequent eye strain.

An additional advantage inherent in the plastic diffusing ceiling is the flexibility in architectural styling which the new system offers. As an integral part of the architectural plan, the plastic sub-ceiling is designed to conceal any pipes, wires, or similar fixtures that clutter up the true ceiling. In the event that air-conditioning or heating systems are to be piped into the room, the space between the sub-ceiling and the true ceiling can be used as a duct through which the air is pumped.

Without the use of plastics materials, the job of translating the concept of the "ceiling of light" into reality would have been almost impossible. For some time prior to the adoption of the plastics sheets, experiments were conducted with glass—the logical contender for the application—but, as is to be expected, the material proved much too heavy, too costly, and too fragile to work with.

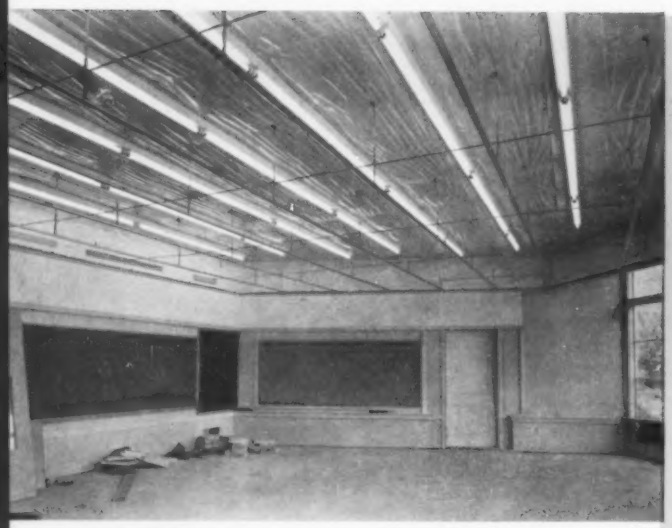
Plastics, on the other hand, proved ideally suited for the application. By forming the sheets into corrugations or three-dimensional shapes, the transverse strength of the material is increased sufficiently to enable it to be stretched unsupported



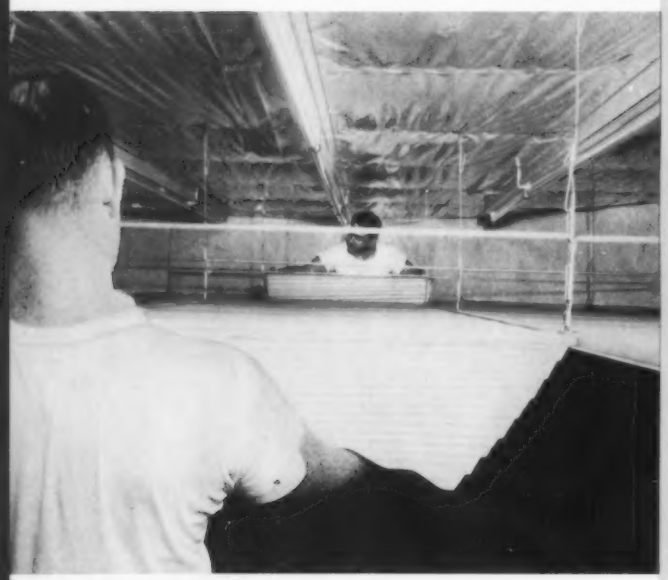
Selected colors can be printed on the vinyl panels to improve illumination

Photos courtesy Bakelite Co.

Rigid vinyl diffusing panels vacuum formed with attractive three-dimensional circle patterns can be arranged in modular designs to create a special lighting atmosphere



Prior to installation of a vinyl ceiling in a new school room, strips of white vinyl-coated paper are stapled to the true ceiling to increase reflectiveness



Aluminum tracks are then hung by brackets from the true ceiling and the roll of flexible vinyl sheeting is started onto the tracks through a set of slots at one end

Only two workers are needed to complete installation of the ceiling. While one holds the end of the panel in place, the other unrolls the stock onto the tracks

Photos courtesy Monsanto Chemical Co.

over relatively large spans. The light weight of the plastics sheets, their excellent light transmission and diffusion characteristics, and their outstanding dimensional and color stability were additional points in their favor.

Vinyl Panels

Lighting systems utilizing vinyl panels are supplied by several companies, included among which are Daylight Ceiling Co., San Francisco, Calif.; Luminous Ceilings, Inc., Chicago, Ill.; Marlux Corp., Somerville, Mass.; Quantalite, Inc., New York, N. Y.; Smithcraft Lighting Div., Chelsea, Mass.; and Sylvania Electric Products, Inc., Salem, Mass.

According to each of these companies, the selection of the calendered vinyl sheeting for the diffusing panels was based on the ease with which it can be fabricated and installed, its very low thermal expansion, and the ease and economy with which it can be maintained.

A vinyl panel, in the standard 0.007-in. thickness, weighs approximately ½ oz./sq. ft.; the complete installation, in fact, including lamps, fixtures, hanging track, etc., weighs only about 1½ lb./sq. foot. The flexible material will not shatter or break, if accidentally dropped.

Flexibility also contributes to the ease and economy with which the vinyl diffusing panels can be installed. If square-shaped single panels are combined to make up the plastic ceiling, each unit is snapped into the metal clamps suspended from the ceiling for a secure installation. Roll material, pre-cut from continuous length of vinyl sheeting, is equally as easy to install. The material is simply unrolled out so that it rests on hanging tracks — either aluminum or steel inverted T-bars — suspended by straps about 2 to 3 ft. below the true ceiling.

Colored Sheets

To date, most of the vinyl ceiling panels have been fabricated of white translucent sheeting. The recent introduction, however, of translucent vinyl sheets that are printed with selected colors before being formed into corrugated diffuser shields has attracted attention among lighting engineers. Developed by Quantalite, Inc., New York, N.Y., using vinyl sheets supplied by

Bakelite Co., the colored diffusing panels are claimed to add a natural color balance to fluorescent light that brings out the true color and texture of everything exposed to the light. When ganged up end-to-end and mounted below the lighting source, therefore, the diffusing panels are particularly adaptable for use where products such as food, textiles, clothing, furnishings, and decorative materials are merchandised — permitting more accurate color selection and matching. The formed shields are distributed by Plastic Illuminating Co., Inc., New York, N.Y.

Daylight Ceiling Co. has also developed a method of coloring portions of the surface of its vinyl panels so that relief designs can stand out in color. The Celotex Corp., Chicago, Ill., distributes Daylight panel lighting systems.

Maintenance

Once installed, the vinyl ceiling panels need be removed only for cleaning or when any of the fixtures above the sub-ceiling need repairing.

To clean the plastic ceiling, the moisture-resistant vinyl panels are simply removed from the tracks, washed in a mild detergent solution, passed through a water-soluble wax solution, and set aside to drain off and dry. A special machine, designed to facilitate the washing of the longer panels of corrugated vinyl, is available from the suppliers of such panels for purchase or rental.

Although the warp-resistant, dimensionally stable vinyl sheet is unaffected by the heat generated by the fluorescent lamps, the fact that it softens when higher temperatures in the 140 to 150° F. range are reached adds much to its value as an architectural material. The self-extinguishing sheet, which has Underwriters' Laboratories approval, begins to lose its shape when the higher temperatures are reached, softens, and drops out of its tracks a few minutes later. Since sprinkler systems generally will go off at 165° F., the vinyl ceiling can be used to conceal the unsightly sprinklers without limiting their fire-fighting effectiveness.

In corrugating the rolls of vinyl sheeting, both Luminous Ceilings,

(*To page* 222)

Courtesy Rohm & Haas Co.

Unsightly lamp fixtures, wiring, pipes, etc. installed in the space between the corrugated acrylic diffusing ceiling and the true ceiling are not visible from below

Courtesy The F. W. Wakefield Brass Co.

Broad-area translucent ceiling made up of extruded corrugated acrylic panels provides a near ideal in seeing conditions for personnel working in the room beneath it

Courtesy Rohm & Haas Co.

Center sections of acrylic panels are cut out to accommodate grilles for air conditioning system which pumps air into the space between the plastic ceiling and the true ceiling

Inspector marks damaged areas on freight car wall for reconditioning. Defects were caused by loose bolt heads working through to car interior

Strips of glass cloth, for use as reinforcing medium in car reconditioning, are cut to size along marked-up wall

'Rough' Freight Cars Made Smooth

A NEW method of reconditioning the floors and walls of "rough" freight cars, based on the use of vinyl chloride resins in combination with glass cloth reinforcement, has been developed by the Rock Island Railroad and is being used extensively by that line. A number of other railroads are currently studying the process, which offers important savings in time and money.

Although the Rock Island program is still in the experimental stage, several dozen cars have been repaired by means of the vinyl-glass cloth system, and Rock Island officials report that a large number of additional cars will be similarly processed during the current year. This line normally reconditions around 15,000 box cars annually. Adoption of the new method, they estimate, would save hundreds of thousands of dollars annually.

"Rough" freight cars are those which, through prolonged service and constant loading and unloading, develop holes in floors and sidewalls through which grain and other commodities leak in transit, resulting in sizable aggregate losses each year; in addition, splinters in floors and walls of "rough" cars puncture bags and other containers and also pose a constant personnel hazard. Con-

(*To page* 226)

After damaged area has been sprayed with vinyl, layers of glass cloth reinforcement are placed over it and sprayed with a final coat of plastic

"Smoothing out" job is complete. Reconditioned sections of freight car have good resistance to cracking and breaking

Photos courtesy Rock Island Railroad

All-Phenolic Projector

THANKS to the professional appearance and sleek styling of its molded phenolic housing, a small reflecting projector, originally conceived as a toy, has shown considerable potential for sale in camera stores as a photographic accessory item.

When in use, the projector is placed with its bottom opening over the subject matter—snapshots, drawings, coins, stamps, or printed matter—that is to be viewed. When the light bulb is turned on, the subject matter is reflected by a mirror out through a magnifying lens and onto a wall or screen.

In addition to the two-piece main housing, the projector incorporates a molded phenolic lens barrel and a molded phenolic holder for the light bulb socket. The only non-plastics parts in the entire unit are the glass mirror and lenses and a metal foil reflector whose function it is to concentrate the light from the bulb.

According to Sid Bersudsky & Associates, designers of the projector, the resistance of phenolic to the heat generated by the light bulb and the smooth, lustrous black finish of the molded parts were important factors in the selection of phenolic as the molding material. Equally as important was the design potential of the material which enabled the main housing to be limited to only two pieces that incorporated all the necessary holes for fastening the two halves together and all the various recesses and bosses which hold the lamp socket, the reflecting mirror, and the foil light reflector in place.

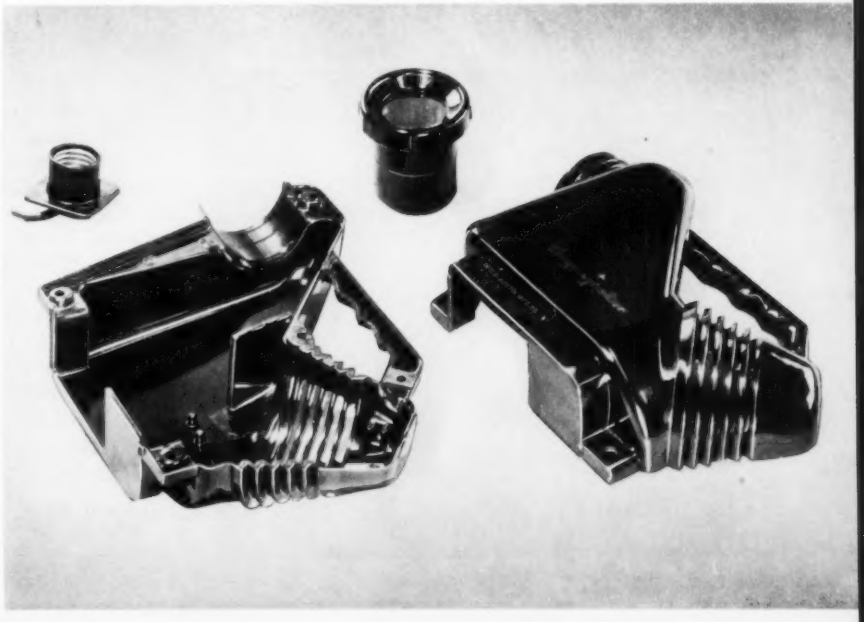
The two halves of the housing, which are identical in basic outline and size, are molded in a two-cavity mold in a 350-ton compression press. Molded into the top of each part is one half of an integral hollow carrying handle. When the unit is assembled, two projections molded into the feet of the two halves of the handle match up to separate the handle from the rest of the housing and thus prevent any heated air within the projector from rising into

(*To page* 228)

Courtesy Sid Bersudsky & Assoc.

Market potential for easy-to-operate reflecting projector is considerably increased by its attractive two-piece molded phenolic housing with integral carrying handle

In addition to the two almost identical halves of the housing (foreground), the socket holder (top, left) and lens barrel (top, right) are molded of heat-resistant phenolic



Fire Extinguisher With Molded Head

Push-button-type fire extinguisher, small enough to be carried in the glove compartment of a car, consists of two basic parts—a head molded of phenolic with a molded-in brass valve assembly, and a stainless steel shell. When the unit is filled and compressed air introduced, a vaporized stream of carbon tetrachloride can be released by pressing the polyethylene button on the head. Air pressure can be maintained by forcing air through the nozzle into the shell. The extinguisher comes equipped with a metal bracket for mounting the unit directly onto a wall.

The head is transfer molded in a four-cavity mold on a 100-ton hydraulic press with a 3½-ton top transfer ram. The valve body is inserted into the molding die prior to the actual molding. The nozzle screws into a threaded hole molded into the head. Minimized machining and closer tolerances of the complete head plus the elimination of one assembly operation were the main advantages of directly molding the valve body and threaded hole into the head.

CREDITS: Molded by Shaw Insulator Co., Irvington, N. J. and Mack Molding Co., Wayne, N. J. for Pyrene Mfg. Co., 560 Belmont Ave., Newark, N. J. Phenolic supplied by Monsanto Chemical Co., Springfield, Mass.

Flexible Blocks With Built-in Whistle

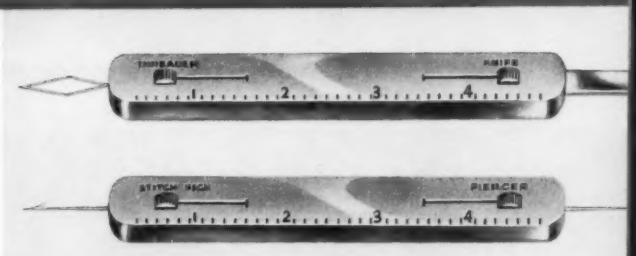
Vinyl toy blocks, called Kwee Kee, stoutly resist the wear and tear wrought by youngsters on conventional blocks. When the flexible blocks are squeezed or kicked, a noise comes from a whistle inserted in one side of each block. Each surface of the blocks has letters and nursery characters molded in relief. Blocks are available in sets of five, colored red, blue, yellow, green, and orange. Sets are packed in containers with positioning holes for the blocks.

Blocks are manufactured by the slush molding process using a vinyl plastisol material. Casting molds are exposed to a temperature range of 500 to 700° F. for approximately 5 min. to form a uniform wall section. Whistle holes are molded in the block caps and the whistles are inserted by hand after the molding operation is completed.

CREDITS: Slush molded by Kusan, Inc., 2716 Franklin Rd., Nashville, Tenn. Vinyl plastisol supplied by Flexible Products Co., Marietta, Ga.

PRODUCTS

Sewing Aid



Molded of styrene, a new sewing aid is actually five sewing tools in one. The styrene holder doubles as a 4-in. hem ruler and as a housing for a piercer, a stitch pick, a knife, and a needle threader. As a safety precaution, each individual tool is mounted on a retractable slide so that it can be completely sheathed when not in actual use. When buttons are pressed, the tools slide out and lock in place when they reach the open position. The lightweight combination tool is compact to make it suitable for a sewing basket or for traveling.

The holder is molded of styrene in two parts on an 8-oz. injection molding machine. Parts for six complete units are molded in a 12-cavity die at the rate of 720 units per hour. The two halves are joined by heat-sealing the center post which is molded in each half and solvent-sealing the edges. All metal parts are inserted prior to the sealing operation.

The tool, called Sew-Handy, is available in red only and is packaged in an acetate window box that holds the item securely in place.

CREDITS: Molded by Connecticut Plastics Co., 70 W. Liberty St., Waterbury, Conn. for Dart Craftsman Corp., 240 Madison Ave., New York, N. Y. Styrene supplied by The Dow Chemical Co., Midland, Mich.

Double-Wall Insulated Salad Bowl

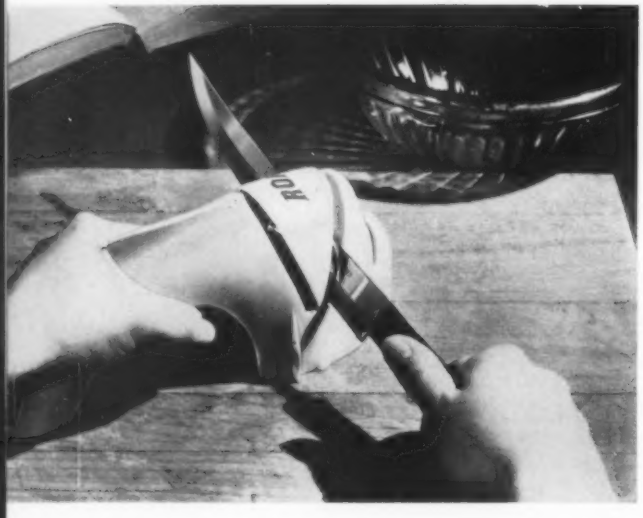
Thermal insulation provided by an air space between the top and bottom portions of each bowl of a seven-piece Thermo Salad Set molded of styrene will keep food hot or cold longer than conventional dishes. The set consists of four individual bowls 6-in. in diameter, a 12-in. salad bowl with a depth of 3¾ in., and two servers consisting of a 12-in. fork and spoon. A mottled effect produced during the molding operation imparts a mahogany appearance to the bowls.

All parts for the salad set are molded in a 12-oz. injection molding machine using a total of six sets of dies. The inner and outer shells are friction locked together without the use of cement, a double rim on the outer shell engaging a circular lip on the inner shell. The sections can be separated if desired; in the photo, the bowl on the box has been taken apart.

CREDITS: Molded by Leaf Plastics, Inc., Yonkers, N. Y. for Jay Don, Inc., 482 Broome St., New York, N. Y. Styrene supplied by The Dow Chemical Co., Midland, Mich.

PLASTICS

Knife Sharpener in Plastic Housing



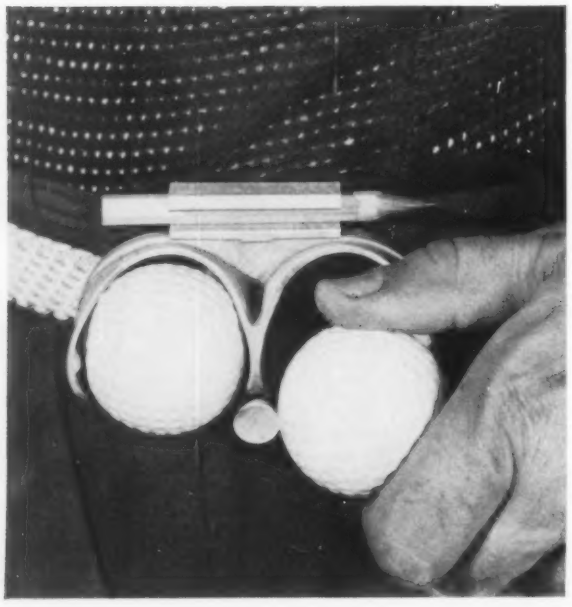
A useful kitchen accessory is a newly introduced knife sharpener, called Rone. Molded of ivory-colored ethyl cellulose, with the exception of the sharpening stone and set of steel hones, the Rone presents a compact and attractive appearance. The top of the unit has two recesses which act as guides to position either side of the knife for rapid sharpening and honing.

The knife sharpener housing consists of three ethyl cellulose parts which are injection molded in a 2-oz. machine. All parts are molded complete in a three-cavity mold. The cover slip-fits over the base. The third part acts as a separator between the honing and sharpening recesses and is attached to the base by means of self-tapping screws, which also lock the parts together.

The sharpener weighs approximately 6½ oz. and is 8 in. long, 2½ in. wide, and 4 in. high.

CREDITS: Molded by Boyden Plastics, Inc., Taunton, Mass. for The Alden Speare's Sons Co., 136 Sixth St., Cambridge, Mass. Ethyl cellulose by The Dow Chemical Co., Midland, Mich.

Golf Ball Holder Worn on Belt



The problem of where to put extra golf balls can be solved by the use of a holder, called Ball-Klip, molded of cellulose acetate butyrate. Weighing only 1¼ oz., the ball holder is designed to be worn on the player's belt in the back, directly over either hip pocket, so as not to interfere with play. Scoring pencil and golf balls snap in and out of position; the tee, when inserted, serves as a safety lock to prevent accidental dislodging of the holder. The Ball-Klip also eliminates the soiling of pockets and the wear resulting from carrying golf balls in them.

Ball-Klip is molded in two parts in a 2-oz. injection molding machine using a two-cavity mold. The duration of the molding cycle is approximately 28 seconds. Following the molding operation, the belt clip and ball holder are cemented together to complete the unit.

Available in red, green, and blue, Ball-Klip is retailed in two packages—regular, with pencil and tee; and gift packaged, with pencil and tee and two golf balls in an acetate covered container.

CREDITS: Manufactured by Ball-Klip Mfg. Co., P. O. Box 324, Boulder, Colo. Cellulose acetate butyrate supplied by Eastman Chemical Products, Inc., Kingsport, Tenn.

PRODUCTS

Colored and Metallized Christmas Figures

Two sets of figurines depicting the Three Wise Men are a new addition to the ever-growing group of plastics Christmas decorations. Molded of styrene, each figurine represents a wise man mounted on a camel. The decorative models are boxed three in a set and are available in two distinct color styles.

One color style consists of brown camels with gold bridles and a range of colors for the capes of the wise men. In the other color style, the figurines are metallized and their capes are colored.

The figurines are molded in an 8-oz. injection molding machine using a four-cavity mold. The two halves are then solvent-cemented together to complete the items. The metallized figures are coated with clear lacquer to protect the aluminum finish and are then trimmed in colored lacquer for an all-over lustrous finish.

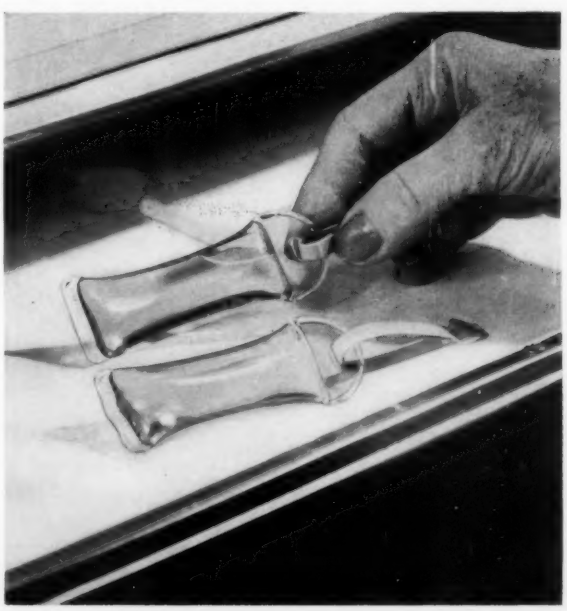
CREDITS: Manufactured by Bradford Novelty Co., Inc., 760 Main St., Cambridge, Mass. Styrene supplied by The Dow Chemical Co., Midland, Mich.

Water-Filled Teething Aid

Developed for the easing of baby teething distress, a water-filled vinyl tube, called Teeth-A-Babe, provides a cold, soothing surface for the baby to chew on. Functioning on the cold-compress principle, the soft, allergy-free vinyl sleeve is cooled in the refrigerator before use. A vinyl handle attached to the teether provides an easy grip and the baby can soothe tender gum areas without excessive mouth distortion or danger of choking. The teether can be sterilized by immersing it in boiling water for two minutes.

Teeth-A-Babe is fabricated of ¾-in. diameter vinyl tubing with a 0.030-in. wall thickness. The tube is filled with pure water and electronically sealed in lengths of 2½ inches. One end has an elongated tab with a hole through which the vinyl handle is attached; the ends of the handle are also electronically sealed to complete the loop.

The teether is available in pink, blue, yellow, and green. It is packaged with a punched tab for rack display and can also be featured for tie-on shower gifts.



CREDITS: Made by Progressive Products, Inc., La Mesa, Calif. for W. A. Genesy & Co., 828 S. Los Angeles St., L. A., Calif. Vinyl supplied by Resin Industries, Inc., Santa Barbara, Calif.

Moldable Reinforced Sheet

Properties and handling ease of new pre-impregnated glass stock, available with controlled directional strengths, open up broad opportunities to all molders and fabricators

PRE-IMPREGNATED, ready-to-mold reinforced plastics sheet material in a new form—produced by bonding together individual thin plies of unidirectional glass fiber filaments encased in epoxy or polyester resins, and orienting the layers to achieve engineered strength characteristics in the finished product—has just been announced by the Tape Div. of Minnesota Mining & Mfg. Co., St. Paul, Minn.

Now being marketed in initial production quantities under the tradename of Scotchply brand reinforced plastic, the new formable sheet stock is the result of a ten-year development program aimed at perfection of a reinforced plastics material having exceptional strength and uniformity, while capable of being handled as conveniently by fabricators as sheet metal is now utilized in the metal forming field.

*Reg. U. S. Pat. Off.

Scotchply sheets currently available incorporate epoxy resins. The 3M company is planning, at a later date, to supply material based on polyester resin systems.

The outstanding characteristic of the Scotchply sheets lies in controlled alignment of reinforcing glass filaments, making it possible to tailor the properties of the material to satisfy specific end use requirements.

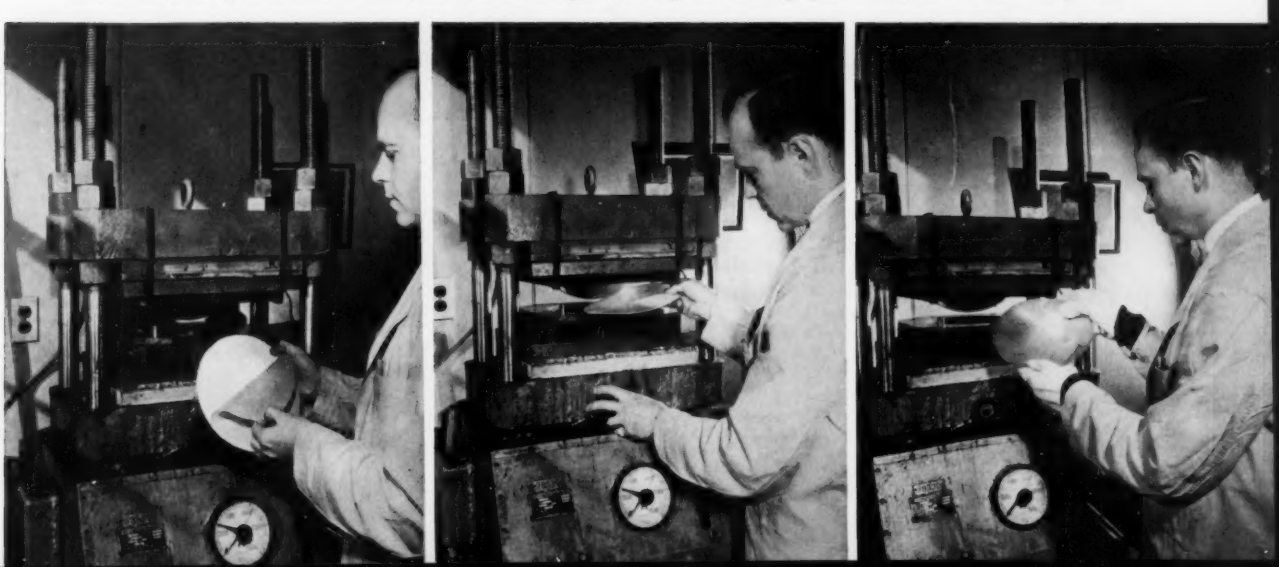
How Sheet is Tailored

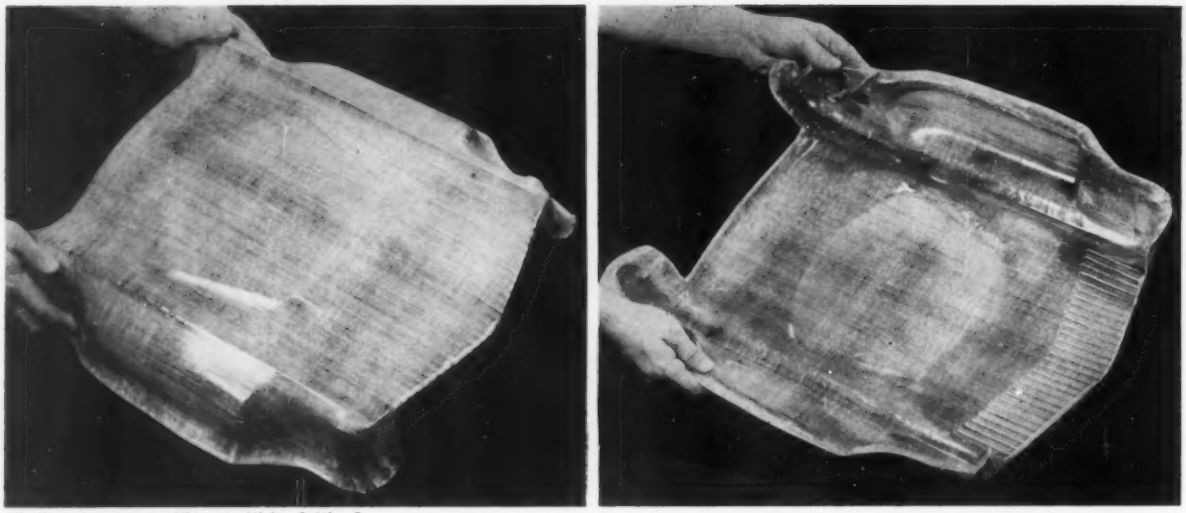
For example, if the application calls for uniformity of strength in all directions in the laminating plane, an isotropic laminate may be used in which successive layers comprising the sheet are oriented at an angle of 120 degrees. If high strength is demanded in two perpendicular directions, a sheet having a simple 90° cross-lamination is used.

However, in cases where exceptional strength properties are required in one principal direction only, the type of sheet recommended is one in which all the lineally aligned glass filaments run in the same direction. In all instances, the thickness of the uncured sheet and the resulting laminate depends upon the number of individual layers in the complete "sandwich." Each ply has a gage of approximately 8 mils.

Within each layer, the reinforcing glass filaments are aligned straight and parallel in shoulder-to-shoulder fashion without crimp, slack, or twist. Resin and filaments are uniformly dispersed, with each finished sheet containing approximately 60% glass and 40% resin by weight. The plies are produced and combined in a continuous manufacturing

Steps in molding dome-shaped piece from new reinforced sheet. Protective liner is removed (left). Blank is inserted between hot matched metal molds in the press (center). Molded piece is removed (right). Forming and molding cycle is described in detail on p. 123





All illustrations courtesy Minnesota Mining & Mfg. Co.

New moldable reinforced plastics sheet can be molded into intricate shapes with complex draws. The possibilities in this direction are shown by the top and bottom views (above) of an experimental housing for a rotary lawnmower made for Toro Manufacturing Co.

operation developed by 3M, which has applied for patents covering both the formable sheet stock and the production method.

In bringing out Scotchply reinforced plastic, the aim of 3M has been to supply fabricators with an easy-to-handle material which eliminates such costly, time-consuming operations as hand layups and resin saturation in the molder's plant, while producing parts having high strength and more consistent quality than customarily found in reinforced plastics products. Company officials point out that in Scotchply there is no interweaving of glass fibers or sizing material, such as used in making preforms, to interfere with thorough wetting of the reinforcement by the resin. Another detail stressed is the fact that with the parallel alignment of fibers used, the "shredded wheat" type of finish on the molded part is eliminated.

Uniformity of Properties

Because of the "built-in" properties of the Scotchply sheets, most of the human element has been eliminated as a source of property variation. The consistent properties resulting in the molded part may be noted in the relatively small coefficient of variance observed during the numerous strength tests performed on finished laminates, averaging less than 10% in all test programs. This uniformity is apparent in the accompanying charts (based on values obtained with epoxy resins), showing strength and directionality properties of Scotchply laminates.

In addition to tailored physical properties, the system of continuous lamination used in preparing the uncured Scotchply material makes it possible to provide built-in color and other surface effects on the outer surface. During the molding and curing operation, these decorative finishes are sealed into the laminate, eliminating the need for subsequent painting or application of decals, transfer sheets, etc. Such inherent finishes, it is pointed out, might be used on industrial equipment, lawn-mower housings, and numerous other products, such as station wagon body trim. It is questionable, however, whether the inherent colors would be acceptable on relatively expensive consumer products, such as automotive bodies, where buyers are particularly critical about color finishes and where color matching would involve a serious problem when surface repairs must be made.

On color and wood grain effects, the decorative surface is reproduced on a fibrous glass system which is laminated into the sheet in such a manner as to form the top surface. Scotchply may also be supplied with the top surface comprised of a thin copper sheet, for use in printed circuit panels.

Another interesting illustration of the inherent surface effects possible with this new formable sheet stock is the incorporation of a reflective Scotchlite surface, in which thousands of tiny glass beads, incorporated into a plastic film backing, are sealed into the outer face of the laminate beneath a layer of resin. One suggested application for such a sheet would be on a station wagon body, in which a strip of the reflective material would be incorporated across the back or at other desired points. This strip would be invisible except when struck by a direct beam of light, such as automobile headlights.

Scotchply sheets having no built-in color or other decorative effects may be given a lacquer spray finish similar to those used on other types of glass fiber laminates. Here the smooth surface of the laminate, undisturbed by the presence of random fibers, makes for a particularly attractive finish. The sheets may also be drilled, sawed, punched, sheared, and otherwise fabricated, using conventional methods.

Molding Methods

Designed for processing into finished form by means of pressure bag molding, vacuum bag molding, or with matched metal or plastic dies, Scotchply reinforced plastic is distributed in flat or roll form, depending upon thickness. Although sheet sizes have not yet been standardized, the 48-in. width may become the basic standard. The 3M company is now surveying sheet

sizes and distribution practices followed by steel companies in supplying sheet steel to metal fabricators. Automatic equipment used in making Scotchply permits widths up to 6 ft., with length limited only by practical considerations of shipment and handling; sheets as large as 6 by 40 ft. have been made experimentally. Large sheet sizes make the material suitable for sizable structures such as aircraft surfaces, industrial storage vessels, and similar applications, with the glass reinforcement properly aligned to provide desired directional strength characteristics. The uncured sheet material is shipped to the fabricator with both sides protected by means of a crepe paper cover sheet which is easily stripped off prior to molding. As received by the molder, the material is relatively rigid, facilitating transportation and handling.

The shelf life of Scotchply based on epoxy resins is approximately one month at 75° F. and four months at 40° F. Upon long aging at higher temperatures, Scotchply reinforced plastic becomes more rigid. To return the sheet to its original flexible state, it may be warmed slightly through exposure to a temperature of approximately 110 to 115° F. This should not be done, however, unless the sheet is to be molded within a short time.

Although experimental Scotchply sheets have been produced as thick as ½ in., the manufacturer believes that the greatest volume of use will be in the ⅛-in. (0.125) thickness. There is a reduction in the gage of the sheet of from 10 to 20% during the molding operation, depending upon the amount of pressure and other variables.

Using Scotchply pre-impregnated sheets, many items may be fabricated using vacuum or pressure bag techniques. For areas of extreme curvature, it is recommended that a male plug be employed in conjunction with the bag and mold. Curing may be hastened by heating the mold itself.

Although parts can be vacuum bag molded at pressures available with that method, it is recommended that, for producing parts with sharp draw, matched metal molds and pressures above 25 p.s.i. be employed. Polished steel molds having a tin-plated surface are favored.

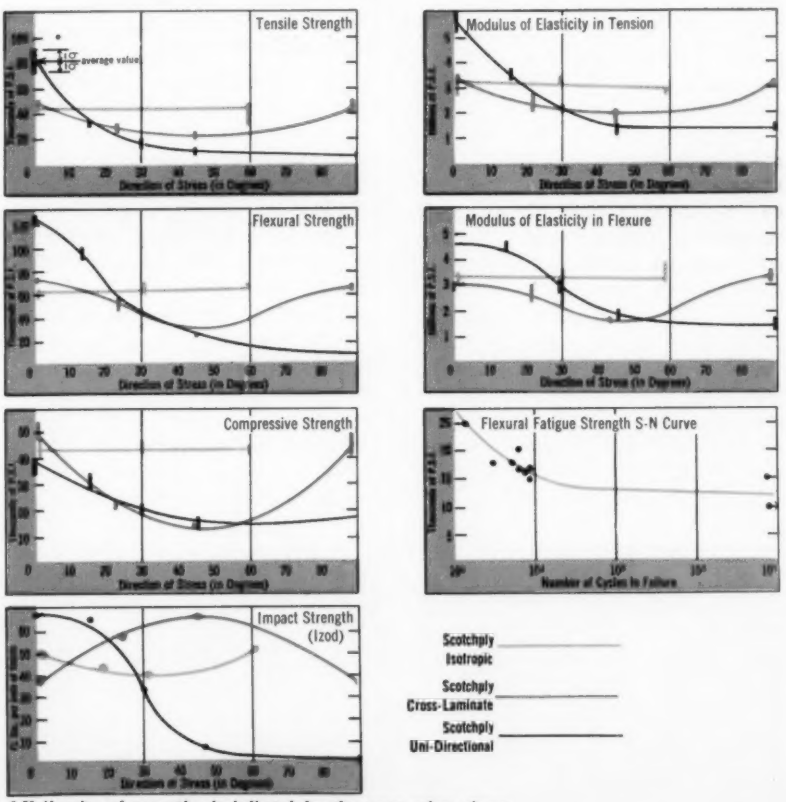
Prior to molding, the mold is prepared with a suitable epoxy system release agent. With proper application of 3M FC-400 mold release on a clean mold surface, from four to six clean partings should be obtained before re-application of the release agent is necessary.

Formed, Then Molded

After removal of the protective paper liner from both sides of the Scotchply sheet, the sheet is inserted between the prepared mold faces. Care should be exercised to avoid shifting the sheet after it has made contact with the heated surface, as this may disrupt surface fibers. With the mold hot, the sheet is formed by closing the mold gradually as the sheet becomes thermoplastic. As soon as the sheet has been formed, full molding pressure is applied for a moment and then released to minimum contact pressure for the gel period. Full molding pressure of 25 or more p.s.i. is then re-applied for duration of cure.

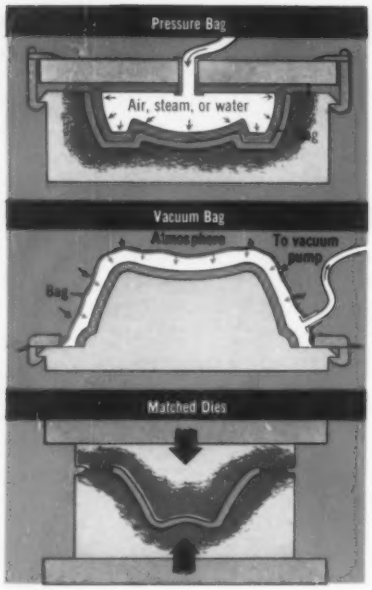
The short exposure to full molding pressure before gelling forces out any entrapped air and gives good

Structural angles and (left) housing molded of new reinforced plastics sheet



* Uniformity of properties is indicated by the range values shown

Strength and directionality properties of Scotchply reinforced plastics sheet. Property uniformity is good because material is manufactured under carefully controlled conditions



New reinforced sheet can be processed by conventional molding methods. Cycles and temperatures are given in text

conformability. The gel period is a fluid resin phase which varies with the age of the material and the molding temperature; a representative period would be from 1 to 5 min. at 330° F. With a closed mold where there is no resin flow, full molding pressure may be applied immediately after forming. With an open mold, such as in curing a flat panel, pressure applied before gelling may cause excessive resin flow-out; if pressure is applied too late, the result may be a molding with poor surfaces and density.

The correct gel time under the existing conditions may be determined on the first molding by alternately increasing and decreasing the pressure. The material has gelled if there is no resin flow out of the mold or if the pressure gage indicates no drop in pressure.

Typical total cure times, including gel period, are as follows:

10 min. at 400° F.
and 25 (or more) p.s.i.
35 min. at 330° F.
and 25 (or more) p.s.i.
100 min. at 270° F.
and 25 (or more) p.s.i.

The first set of conditions given above is preferred. While a lower temperature may be used, it must be at least 270° F.

Continued resin research by Minnesota Mining and its epoxy resin suppliers is expected to result in progressive reductions in cure time for the Scotchply sheet material. Shorter cures at lower temperatures also may be expected from material incorporating polyester resin systems, expected to be made available at a later date. At present, however, 3M is concentrating its program on the epoxies, favoring them for their greater versatility, stability, better finishes in the molded parts, superior adhesion to glass, lower moisture sensitivity, and improved electrical properties. 3M spokesmen state that these resins are also easier to handle and make for a more uniform sheet material.

Depth of Draw

The deepest draws thus far made with the material are of the order of 6 to 8 in., but it cannot be stated at this time that this is the limit; the shape and size of the part must be taken into consideration. Nor has it been definitely established how deep a draw may be made with precolored or pattern-surfaced material without impairing the appearance of the decorated surface. Further investigation is expected to provide an answer on points of this nature.

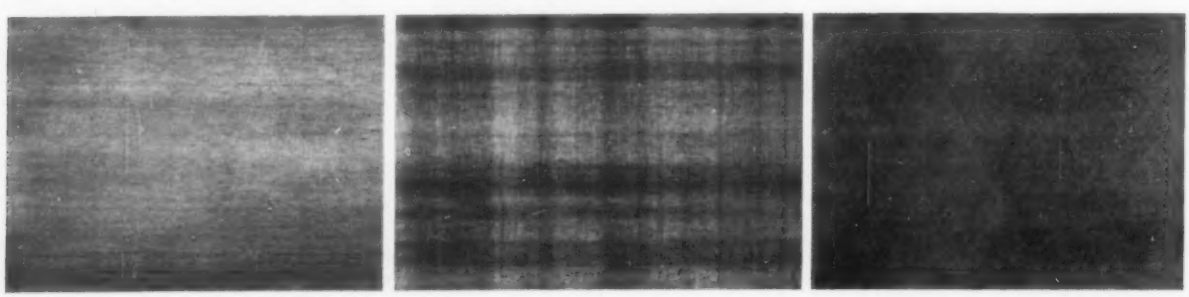
The 3M company has also set up its own tool department to study typical molding problems and is assembling data on the prediction of properties in drawn parts. This investigation will cover not only items involving a single type of sheet with reference to orientation of glass fiber reinforcement, but also structures involving various combinations of unidirectional, cross-laminated, and isotropic sheets.

Since in the molding process Scotchply is formed through the initial application of heat and pressure, then cured, 3M has been surveying possible combination molding and postcuring methods which would produce rapid production cycles while requiring a minimum number of molds. With new resin systems becoming available, the period required to shape the heated sheet to final form could be relatively short and continued pressure may not be necessary for final cure. Under such conditions, provision could be made to use one or more male forms in combination with a number of mold cavities, with the male forms lowered into the cavities long enough to form the part, then withdrawn and lowered into another cavity in a continuous operation. Final cure would then take place in the cavity section of the mold as it progresses through a controlled heat zone.

Possible Applications

Among the most logical market outlets for the new Scotchply reinforced plastic sheets, according to Minnesota Mining, are storage vessels, tank truck bodies for the oil and chemical industry and other large structures in which corrosion presents a problem, and where uniform, superior strength characteristics are desirable. The material, currently under study at Wright Field, is also considered suitable for numerous aircraft applications ranging from guided missile components

Backlighted panels of Scotchply showing (left) uni-directional, (center) 90° angle, and (right) 120° angle reinforcement



to military aircraft protective armor and radomes having a rain erosion-resistant layer built into the laminate. Lightweight, high-strength pallets and multi-trip industrial containers which could be knocked down for economical return shipment are indicative of other products for which the material appears particularly well suited. Also available in a special electrical grade, Scotchply is expected to find many outlets in the electrical field for printed circuitry and other uses.

Soon to be attempted will be an industrial type battery container that will be molded in metal-faced dies, using the regular isotropic material for all-around strength characteristics. The molding temperature to be used for this part will range between 300 and 400° F., reducing cure time to a minimum. Somewhat similar in size and shape to the battery container is a small housing, experimentally produced in matched metal dies. This part was molded on a 30-min. cycle, using a temperature of 330° F. Before being placed in the mold, the ⅛-in. material used in fabricating this housing was placed in a 110° F. oven for a few minutes in order to preheat the laminate and facilitate placing it in the die.

An interesting structural part prototype which has been molded of a combination of unidirectional and isotropic Scotchply sheets is an L-section beam measuring 3 in. on the flanges and 6 ft. long. Using an oven temperature of 330° F., this part utilized both vacuum pressure and supplementary clamp pressure to hold the die closed. Girders of this type are to be installed as supports in dip tanks used in a chemical processing plant. Metal girders customarily used for this application are attacked by corrosion and often require frequent replacement.

Pilot plant production of Scotchply is now running approximately 30,000 lb. per month. Production equipment now being installed, however, is expected to have an initial capacity of around 1,000,000 lb. per month after the first of the year, according to present plans. When volume justifies, on parts of complex shape which might require cutting or tailoring to conform smoothly to the mold, Minnesota Mining is in a position to supply

(*To page* 233)

Properties of Scotchply Reinforced Plastic

Physical Properties (Values Obtained on Isotropic Sheet Stock)

Glass (wt.)	60%
Resin (wt.)	40%
Molding pressure	25 p.s.i.
Cure time	35 min. at 330° F.
Tensile strength (A.S.T.M. D 638-52)	41,000 p.s.i.
Modulus of elasticity in tension	3.00×10^6 p.s.i.
Flexure strength (A.S.T.M. D 790-49T)	64,500 p.s.i.
Modulus of elasticity in tension	3.20×10^6 p.s.i.
Repeated flexural fatigue strength (like A.S.T.M. D 671-51T)	
28,000 p.s.i. stress	1000 cycles to failure
13,000 p.s.i. stress	5,000,000 cycles without failure
Compressive strength (Fed. Spec. L-P-406b Method 1021.1)	42,000 p.s.i.
Izod impact strength (A.S.T.M. D 790-49T, notched)	45 ft.-lb./in. notch
Rockwell hardness (A.S.T.M. D 785-51) (M) scale	105
Water absorption (A.S.T.M. D 570-42) 24 hr. at 70° F.	0.002%
Heat distortion (A.S.T.M. D 648-45) at 264 p.s.i.	350° F.
Specific gravity	1.80
Approximate wt./sq. ft.	
1/16 in. = 0.58 lb.	
1/8 in. = 1.16 lb.	
1/4 in. = 2.32 lb.	

Chemical Resistance (A.S.T.M. Test Method D 543-T43)

Chemical	% *Change in weight*	% *Change in thickness*	% *Change in length*	% *Change in width*
Heptane	+0.01	0	0	0
Isopropyl alcohol	−0.02	−0.08	0	0
Ethylene glycol	−0.01	−0.10	0	0
Jet engine oil	+0.05	−0.10	0	0
Jet fuel	+0.01	−0.05	0	+0.10
Hydraulic aircraft oil	+0.03	−0.14	0	+0.10
Sulphuric acid 3%	−0.04	0	0	0
Sulphuric acid 30%	−0.03	0	0	0
Sodium hydroxide 1%	+0.04	−0.70	0	0
Sodium hydroxide 10%	+0.38	−1.50	+0.10	+0.09
Hydrogen peroxide 3%	+0.07	+0.12	0	+0.10
Distilled water	+0.003	+0.05	0	0

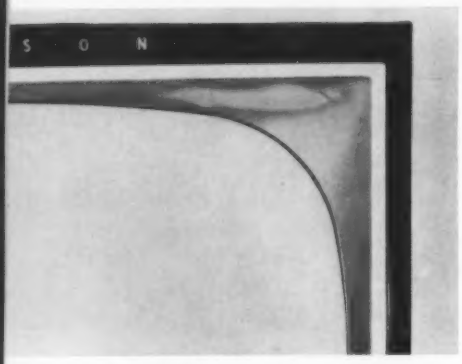
Electrical Properties (Tests Conducted at 23° C., 50% R.H. and at 90% R.H.)

	60 cycles	*1 kc.*	*100 kc.*
Dielectric constant	5.25	5.20	5.10
Dissipation factor	0.0043	0.0049	0.011
Volume resistivity (ohms)	1×10^{16}		
Dielectric strength ..... 700 v./mil			

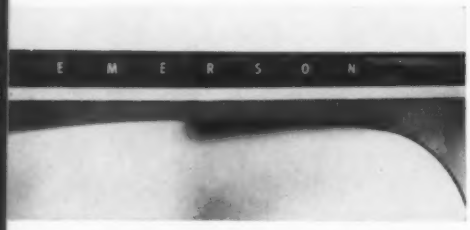
Decoration of Thermoplastics*

How cooperation between designer, molder, and finisher can result in more satisfactory production of decorated plastics parts

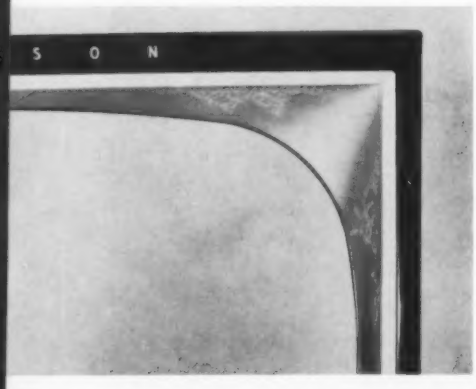
by JOHN I. GRAHAM†



ETCH on television mask results from solvent attack on plastic surface



HUMIDITY BLUSH is due to rapid solvent evaporation under high humidity



LUBRICANT, excessively present in mold or powder, causes poor adhesion

ENGINEERS and others who are primarily concerned with plastic finishing techniques have many common problems, and these in the main are predicated on factors over which they ordinarily have no immediate control.

Thus, when major difficulties arise in applying the desired finish to a molded thermoplastic piece, the trouble can usually be traced to sources outside the finishing department. These sources are three: 1) product design, 2) mold design and construction, and 3) molding operation.

The designer is primarily concerned with the creation of effects which will make for beauty and salability of his product. Too often he does not concern himself too intimately with price, source of supply, or the finishing problems to be encountered in the actual production of his product. When product design and product engineering work closely with those concerned with the actual mold design and with the finishing of the molded part, the resulting exchange of knowledge and ideas is profitable to all concerned.

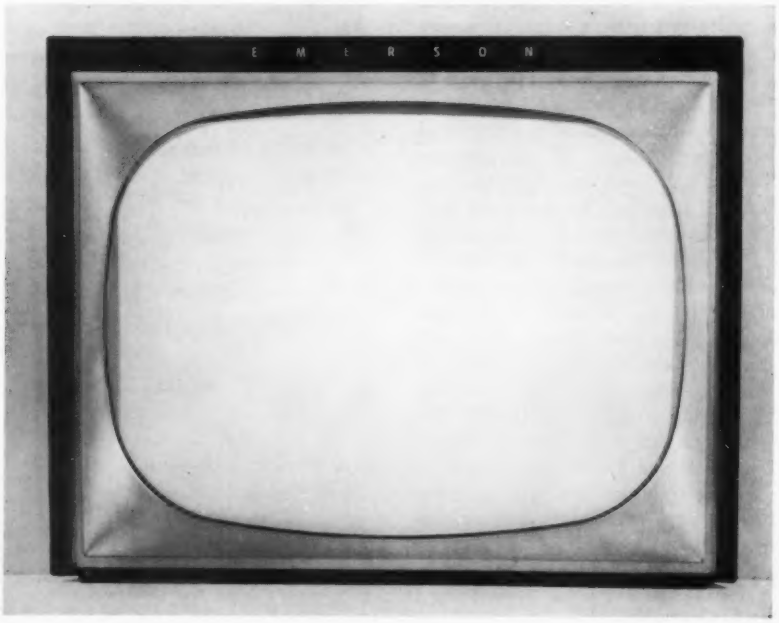
Frequently there is an inclination to let design determine the finishing techniques. Perhaps this is a healthy condition, in that it makes necessary a continual effort to create new and diversified methods; but it certainly is not conducive to economy and, in addition, it makes initial pricing difficult.

There are a number of ways and means of achieving certain effects that are the most practical and economical from the finishing point of view, and which will also satisfy the designers' search for beauty and attractiveness, but they are not necessarily within the knowledge of the designer.

Design Recommendations

If given the opportunity to discuss problems with the designer, the finisher would do well to make the following recommendations:

1) Select the fastest and, therefore, the most economical method of



PERFECT PIECE is obtained by proper control of design, molding, and finishing

* Based on a paper given at the Tenth Annual Meeting of the New England Section of the S.P.I.

† Superintendent of Finishing, Worcester Moulded Plastics Co.

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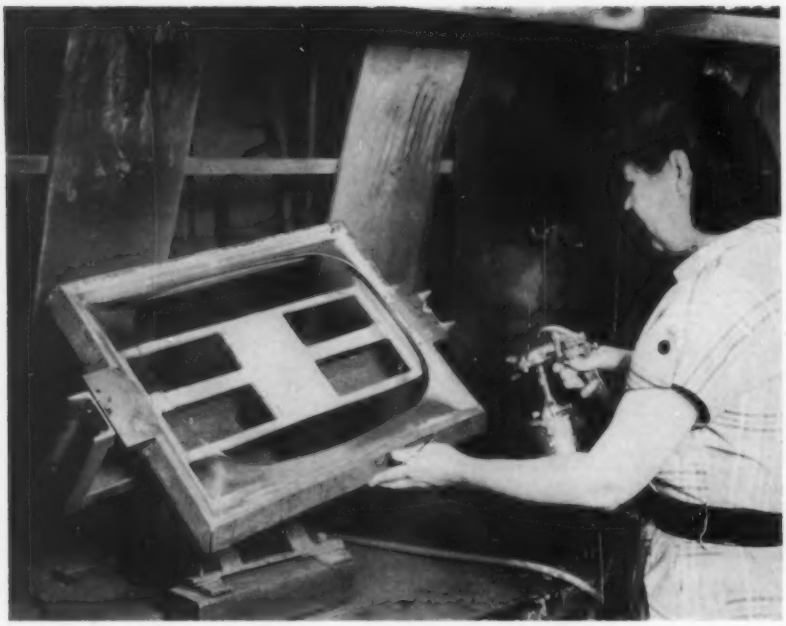


Television mask is spray-painted. For most efficient work, paint spray masks should be so designed that loading and unloading operations can proceed at optimum speeds

molding and finishing that will achieve the desired effect.

2) Avoid deep and narrow holes and grooves, whether first or second surface finishing is required.

3) Avoid abrupt changes in plastic thickness, if possible. Such changes make molding strains unavoidable and make annealing necessary, especially if the part is to be spray-painted.

4) If spray masks are necessary in finishing, make all edges and corners sharp and straight and, if possible, on one plane, so that masks will fit closely. Only a tight-fitting mask will prevent paint by-pass and subsequent expensive wiping operations.

5) If second-surface finishing is required, use extreme care in the location of assembly lugs, ribs, metal inserts, knock-out pins, and sprues.

Mold Recommendations

Of mold design and mold finishing, consideration of the following should be requested:

1) The molded part should be free from objectionable strain, because such strains make finishing difficult; they make annealing imperative, add to the finishing and handling costs, and make expensive equipment necessary.

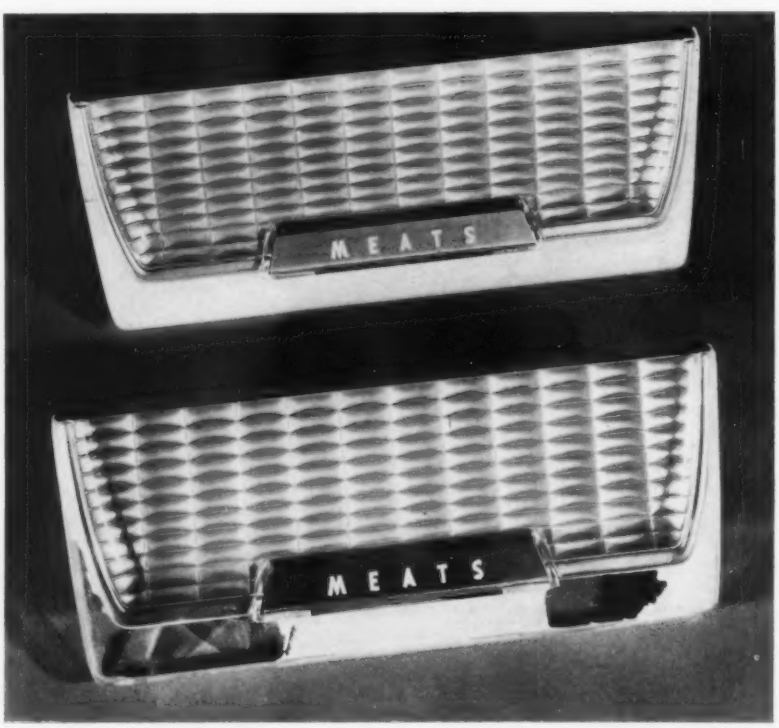
Such molding strains can be minimized if the die is highly polished on all surfaces, if adequate taper is provided on all walled sections, and if knock-out pins and undercuts are skillfully planned and executed.

2) Molds should provide sharp, clear cut-offs for all areas to be sprayed in contrasting colors. Inadequate cut-off makes for overspray, paint by-pass, and costly cleaning operations.

3) A well designed mold will make molding possible without the use of mold lubricants. These lubricants are generally incompatible with the resin systems of paints, and adhesion failure may be expected when paints are applied to lubricated surfaces. Metallizing and stamping, silk screening, or printing will not produce satisfactory results when mold release agents are used, because of poor adhesion.

4) Mold design should provide for proper depth of debossed letters to eliminate weld lines and make filling or spraying easier; proper height and clearance of letters to be top stamped; and, where possible, a clear one-plane surface for best results in silk screening and printing operations.

With a mold possessing all of these qualities, it is essential that the molding operation itself adhere absolutely to a controlled standard. Such control should provide for dimensional stability (so essential



ADHESION of lacquer in molded part at bottom is impaired by use of incompatible paint, use of lubricant during molding, or high humidity during spraying; top part is perfect

For its deluxe shaver

Schick chooses

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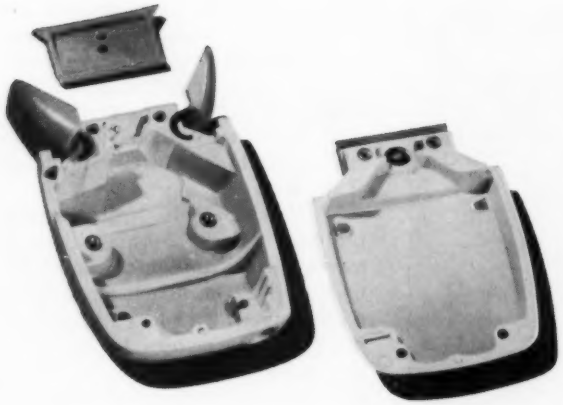
If you have a product you'd like to treat "handsomely," let us tell you about Melmac. Just write for full information.



Molded Melmac case serves as both chassis and housing. This enables Schick to sell its product as a lightweight, highly functional, compact shaver. Melmac also permits molding to exact engineering specifications, and permanently positions the mechanism.

Case molded by Shaw Insulator Corp. and Waterbury Companies, Inc.

AMERICAN Cyanamid COMPANY
PLASTICS & RESINS DIVISION
32 Rockefeller Plaza, New York 20, N. Y.

In Canada: North American Cyanamid Limited, Toronto & Montreal

when spray masks must be used), eliminate objectionable sink marks and flash, and provide parts that are relatively similar in dimension and surface finish.

All of these factors are essential to the practical and economical finishing of a quality part. With them in mind, realistic planning and costing, with primary emphasis on the production of a quality part, can become possible.

Finishing Method

Spray painting is perhaps the method most widely used in the field of plastics decoration. It provides an attractive finish but is a very difficult operation to perform satisfactorily. The remainder of this article will, therefore, deal with this procedure and with the pitfalls that must be avoided.

Colors to be applied are usually determined in the initial design of the plastic part. The molding material to be used must be determined in advance, since the resins commonly used in finishes are related to the plastic surface on which the finish will be used. It is necessary, therefore, to select a finish compatible with the type of thermoplastic material to be used, keeping in mind the qualities required of the painted part, which may be summarized as follows:

1) Adhesion—Whether the part is is to have a first or second surface finish, the finish must possess good qualities of adhesion, especially where surfaces may have to undergo wear or abrasion. The "Scotch Tape test" is a favorite with most quality control men, and no coating will be accepted that does not withstand this test.

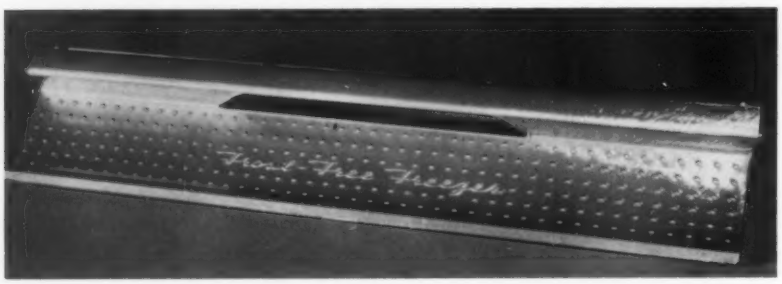
2) Abrasion Resistance—This quality is most important on first surface applications, whatever the type of finish. Pigmented finishes are more desirable in this respect than are the metallic coatings. Metallic particles cannot be as closely bonded in the lacquers as can the pigmented particles. Many metallic finishes do not satisfactorily withstand the "Scotch Tape test."

3) Humidity Resistance—Perhaps the greatest single difficulty with lacquer finishes is their reaction to humidity, which may result in blushing, etching, loss of adhesion, and surface crazing. Humidity reaction does not always show its effect immediately; it may become apparent only after long periods of time, when the finish shows loss of adhesion and gloss and the appearance of surface crazes. Humidity reaction can be controlled only by adjustment of the lacquer thinner. These adjustments lengthen the drying time of the lacquer, thus slowing down the solvent action. It is a good idea to keep a close watch on humidity conditions and control thinner adjustments according to observations.

4) Etch—Etching is a result of solvent attack on a plastic surface and is objectionable, especially for second surface coatings of clear plastic. Plastics have a greater tendency to etch when humidity is low, but thinner adjustments carefully handled can eliminate this difficulty and still maintain satisfactory adhesion of the lacquer.

5) Crazing—This is a common problem in all finishing departments, and severe cases must be handled by control during molding or by annealing. Some slight crazing can be overcome by adjusting the paint formulas, but complete elimination of crazing problems must start with mold design and molding.

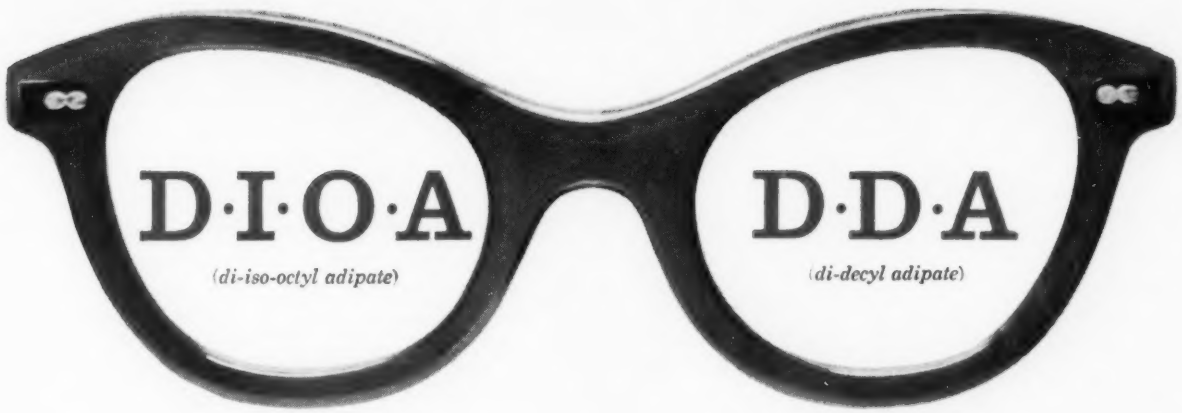
These factors, along with others, such as light resistance, gloss, plasticizer migration, and color matching, can only be controlled through proper selection and handling of the right materials. Conditions of operation must be standardized and deviations must be permitted only when necessitated by external conditions.



CRAZING in upper right-hand corner of freezer part results from molding strains aggravated by solvent action. Remedy lies in redesigned mold, molding adjustment, or annealing

Photos courtesy Worcester Moulded Plastics Co.

Operator removes molded freezer component from electroformed spray mask. This type of mask assures a highly accurate fit, provided all molded parts are uniform



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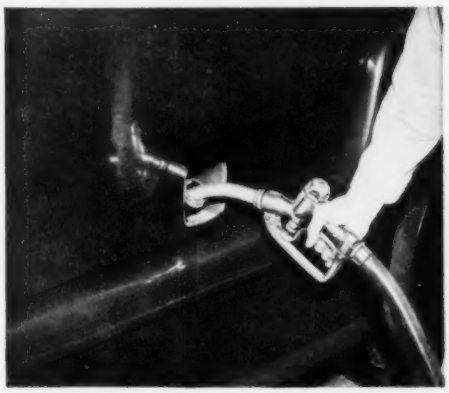

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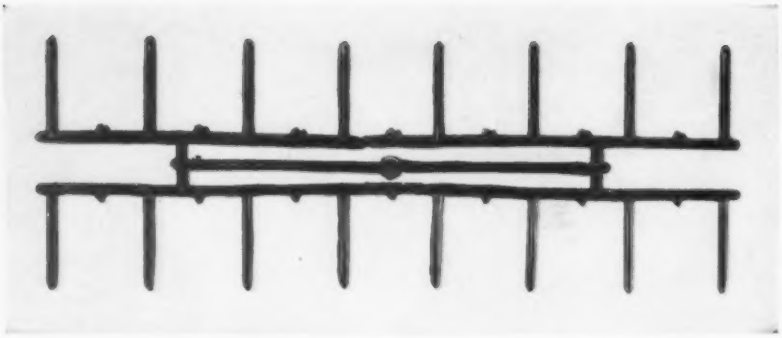


In one approach to balanced gating, runner design does not give equal runner length, but does greatly reduce wide length differential commonly found in standard layout

Balanced Gating*

A formula is presented which makes it possible to calculate gate dimensions for multi-cavity molds or for multi-gated, single-cavity molds

by DAVID A. JONES†

THREE general statements regarding balanced gating in injection mold design will serve as a shortcut in introducing the subject.

1) Balanced gating is a technique of mold design to control the flow of plastic through a gate to give uniform molded pieces.

2) Balanced gating should be used whenever more than one gate is required to fill a cavity or when more than one cavity exists in a mold.

3) Balanced gating can be used to give uniformly molded parts; to control the location of weld lines in multiple-gated single cavities; to eliminate the need for extensive changes in gate size in the mold after installation in the molding machine.

There are two general techniques employed in the field today in endeavors to establish balanced gating.

The first of these is to design and lay out the die so that all cavities are equidistant from the center sprue. When this is possible and practical, it is then necessary only to cut all gates of uniform size to obtain balanced gating.

The second method is to build the die and incorporate gates on the small side. Then the mold is installed in the machine and, by utilizing a series of short shots and opening the gates which are restricting flow, finally arriving at a condition of uniform die filling and balanced gating.

The study of balanced gating establishes a mathematical relationship between the gates. By its use a single numerical value is determined, which represents the weight of plastic flowing through the gate. This should work satisfactorily when molding cellulose acetate, butyrate, or polystyrene.

Before presenting the formula, several conditions should be outlined that must not be present in the mold:

1) The formula is based on the use of full round runners, all of a uniform diameter.

2) A streamline effect should not be present at the gate but rather the extension of normal runner radius.

3) No conditions should be present in the runner system which would cause high pressure loss; these would include turned cavity inserts, turned sprue bushings, and mismatched runner arms.

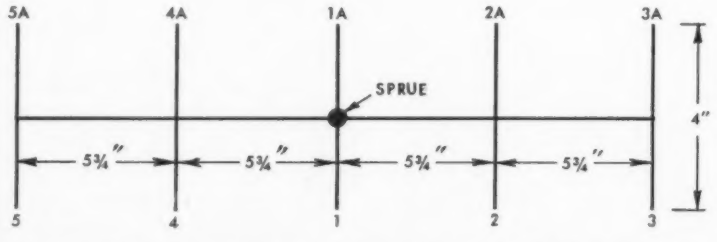
4) In multi-gated single cavities, to effect balanced gating, the distance from gate to weld line must not be less than the distance from gate to the end of the part.

In the use of the formula the molder must still rely on his own design "know-how." This report is offered as a guide to employing his own ideas concerning selection of the initial exact gate lands, runner size, and gate size. Based on his initial selection, the use of this study will give the exact lands and gate sizes to be employed for all additional cavities in the die to effect balanced gating. The formula for balanced gating is:

$$\text{Balanced Gate Value} = \frac{\text{Cross Sectional Area of Gate}}{(\text{Length of Runner to Gate})^{1/2} \times \text{Gate Land}}$$

The balanced gate value is an exact proportion of the weight of material that will flow through the gate. In working the formula where the cavity weights are equal, all balanced gate values are equal. It then becomes a matter of setting up the equations to determine which gate areas will give identical values based on unequal runner lengths to gate and/or gate land.

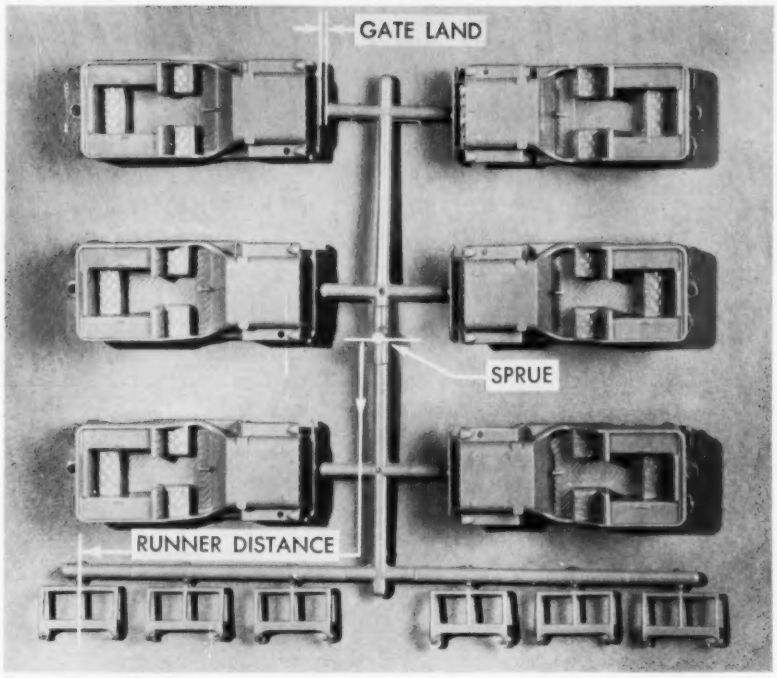
The following is a formula break-



Schematic diagram of gating design for a 10-cavity mold with 0.200-in. runners. This design is used as basis of sample calculation starting on opposite page

* Based on a paper given at the Tenth Annual Meeting of the New England Section of the S.P.I.

† Product Service Dept., Plastics Div., Celanese Corp. of America.



Courtesy Thomas Mfg. Co.

Procedure outlined in text can be used with this mold to prevent packing and flashing of small parts. Meanings of terms (gate land, sprue, runner distance) are indicated

down which shows the factors and their influence:

1) Cross sectional area of gate is the product of the width and depth of the gate. Experiment has shown a direct proportion relationship to flow. If the gate area is doubled and all other factors are held constant, the weight of the material which will flow through the gate will be doubled (area measured in sq. inches).

2) Length of runner to gate is a measurement in linear inches and represents the distance from the sprue to the gate. Plastic flow in a runner is such that the material freezes along the outer shell and there is motion only through the hot center core. The longer the runner, the smaller this hot core will become. In the formula, the effect of a longer runner is to decrease the weight of material passing through the gate at the end.

Experiment has shown that the influence of the runner in resistance to flow is not in direct proportion to length but rather to the square root of the length. With two runners of equal cross-sectional area, one being 16 in. long and the second 4 in. long, the material flow at the end will not be as 16 to 4 but rather as the square root relationship of 4 to 2.

3) Gate land influence is such that increased land will exert more resistance to the flow of material. Gate land is a measurement in inches and represents the distance from the end of the runner to the edge of the cavity. Experiment has shown that land resistance is an inverse proportion relationship. If the land length is doubled, the weight of plastic which will flow through the gate will be halved.

Sample Calculation

It was pointed out earlier that the molder must rely on his own design "know-how" to select runner size, initial gate size, and initial gate land. In the sample calculation, these selections will be based on two rules of thumb of mold design. These rules have proved successful in much molding work done in the field by the writer.

In the sample mold shown in the accompanying drawing, the exact runner size selected is not critical. The runner should not be so small that it offers excessive resistance to flow, and yet it should not be so large that it wastes material. An arbitrary runner size of 0.200-in. diameter is selected.

The selection of the initial gate land is also not critical. The land should not be so long that it causes excessive resistance to flow, such as 0.090 in., nor so short that it causes mold failure, such as 0.010 inch. In the sample calculation an arbitrary gate land of 0.050 in. is selected.

This example is based on a design for a 10-cavity mold incorporating 0.200-in. diameter runners. Two rows of five cavities are laid out so that the rows are 4 in. apart and cavities are 5¾ in. apart in each row (see sketch, page 134). All cavities are listed as producing equal weight parts.

In selecting the initial gate size and land on which all subsequent dimensions will be based, the following rule of thumb may be used: An area relationship between gate and runner, which has been pragmatically found to work out well in actual production design, is based on a theoretical value of 0.07, viz.,

$$\frac{\text{Cross sectional area of gate}}{\text{Cross sectional area of runner}} = 0.07$$

In the sample calculation, a runner diameter of 0.200 in. has been selected. Substitution of values in the formula is as follows, using 0.03142 in.^{2}, which is the area of a 0.200-in. diameter runner:

$$\frac{\text{Cross sectional area of gate}}{0.03142 \text{ in.}^2} = 0.07$$

$$\text{Cross sectional area of gate} = 0.0022 \text{ in.}^2$$

The second rule of thumb states that a relationship of 3 to 1 exists between gate width and depth. This gives a gate which is not excessively deep for finishing, yet offers good filling properties.

If X = gate depth then 3X = gate width

$$(\text{Gate Width})\ (\text{Gate Depth}) = 0.0022 \text{ in.}^2$$

$$(3X)\ (X) = 0.0022 \text{ in.}^2$$

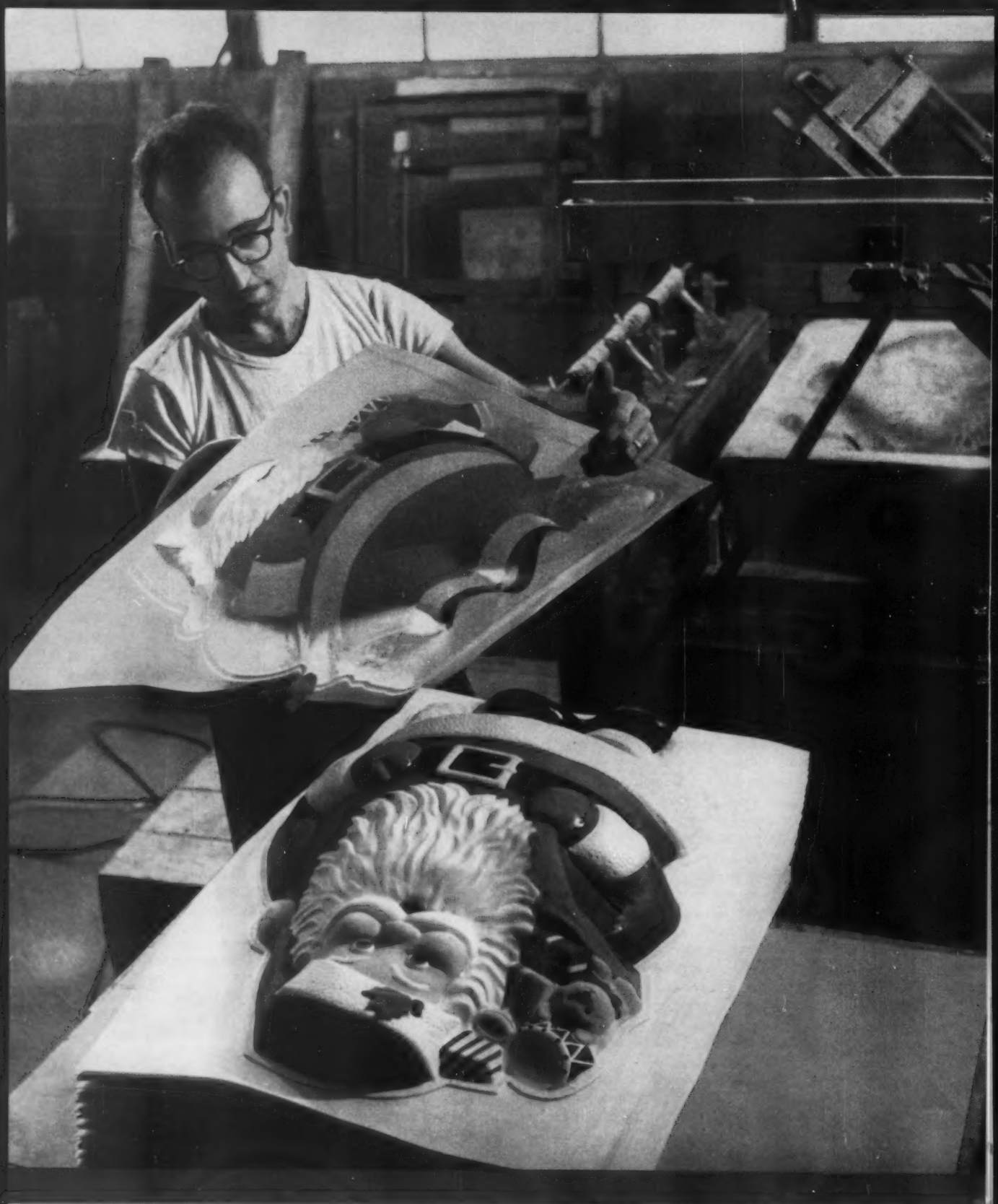
$$3(X^2) = 0.0022 \text{ in.}^2$$

$$X = 0.0265 \text{ in.}$$

Therefore, gate depth = 0.0265 or 0.027 in., and gate width = 3(0.027) = 0.081 in., and initial gate size = 0.027 in. deep by 0.081 in. wide.

In selecting gate land, a constant dimension may be used for all cavities. For the sample calculation, a value of 0.050 in. is selected. The initial selected gate size can be assigned to any gate in the mold and

(*To page* 234)



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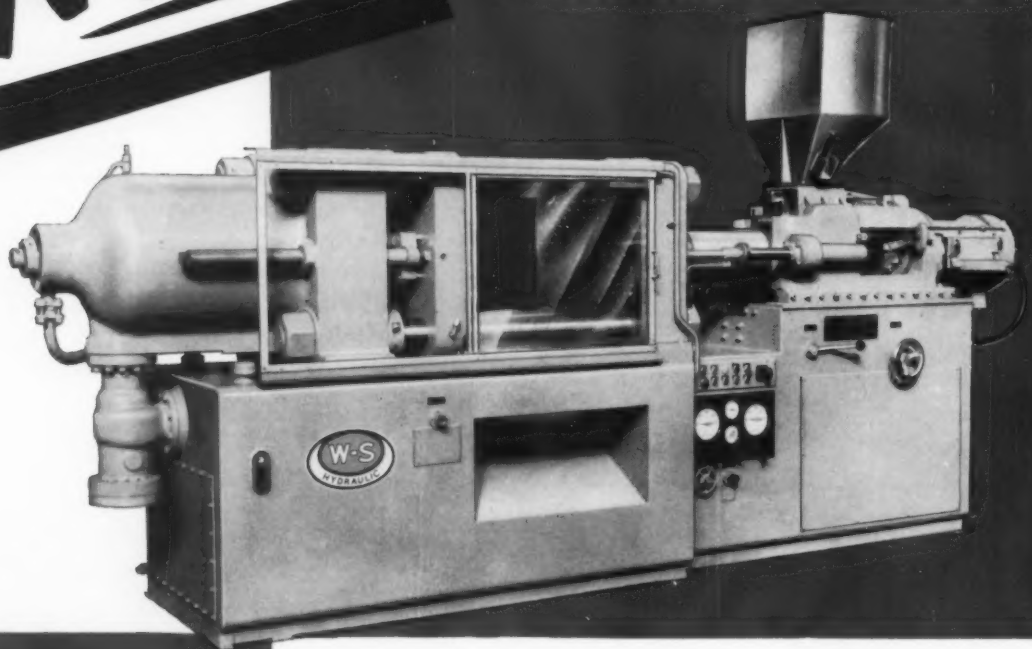

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Metal-Bonding Adhesives With Improved Heat Resistance†

by JOHN M. BLACK‡ and R. F. BLOMQUIST‡

Results are reported of current studies at the Forest Products Laboratory to develop a metal-bonding adhesive with greater resistance to temperatures up to 600° F. that is easier to use than present ones. Most promising is a formulation of phenol and epoxy resins modified with hexamethylenetetramine supplied for use as dry tape supported on glass-mat base.

THE work described in this report is a continuation of the work on adhesive formulations based on phenol resins and epoxy resins reported previously (1).[1] An adhesive designated as FPL-710 that developed promising shear strength when tested at elevated temperatures up to 600° F. and also possessed good resistance to aging at temperatures as high as 450° F. was described. The principal limitations of adhesive FPL-710 were that it was somewhat brittle, it possessed marginal bend and fatigue strength and variable performance at 600° F., and the optimum film thickness for bonding (0.002 in.) was too thin for practical use in aircraft.

The objectives of the investigation were to improve the performance of adhesive FPL-710 at 450 to 600° F. and still maintain adequate shear strength at −70° F., to reduce brittleness, and to improve resistance to bending, peel, and fatigue. The performance of FPL-710 and subsequent improved formulations for the bonding of stainless steel and titanium and their possible use as laminating resins for glass fabrics for service at high temperature were investigated.

Adhesive Preparation

The formulation for the adhesive is 4 g. of hexamethylenetetramine, 100 g. of Bakelite BV 9700, and 20 g. of Epon resin 1007 dissolved in methyl ethyl ketone. Bakelite BV 9700 is a solution containing approximately 60% resin solids, Epon 1007 is a solid resin. The recommended cure of the adhesive is 30 min. at 320° F.

The mat-tape adhesive is prepared by dipping glass-fiber mat of 0.010-in. thickness in liquid FPL-710, allowing it to drain, then air-drying and precuring it at 180° F. The optimum amounts of impregnation and the recommended conditions of drying have not been fully established. Samples of such a tape adhesive aged for 12 mo. at room temperature have shown no loss in resultant lap-shear strength when compared with bonds made initially with the fresh tape.

Test Methods

Test specimens of 0.064-in. 24S-T3 clad aluminum alloy with a 0.5-in. lap joint (2) were used for evaluation of shear strength when made immediately at each of the test temperatures and after the various aging conditions.

Lap-shear specimens were loaded in self-aligning grips at the rate of 300 lb. per 0.5 sq. in. per minute. Bending test specimens were loaded flatwise at the center as a simple beam with a 1.5-in. span at the rate of 200 lb. per minute (2). The loading block was over the center of the bonded area.

Elevated test temperatures were controlled to within ±3° F. of the desired temperature. In tests at elevated temperatures, a period of 3 to 5 min. was required to heat the specimens from room temperature to the test temperature. In tests made at the elevated temperature and at −70° F. the load was applied as soon as the specimen reached the desired temperature.

Unless otherwise noted, the aluminum surfaces were prepared for bonding by immersion for 5 to 10 min. in a solution of sulfuric acid (10 g.) and sodium dichromate (1 g.) in 30 g. of water at 140 to 160° F., followed by a rinse in cold running water, another with hot water or steam, and air-drying.

Strength at 600° F.

It had been previously observed that shear strength at 600° F. would frequently vary from 100 to more than 1,000 p.s.i. (1). In attempting to overcome this limitation, a study was made of many bonding variables and variations in the adhesive formulation of FPL-710. In the course of the investigation, bonding variables studied included the method of metal surface preparation, amount of spread, age of stock adhesive, age of thinned adhesive, degree of solvent removal, bonding pressure, precure, and curing conditions. Variations in adhesive formulation, such as the amount of hexa, ratio of phenol resin to epoxy resin, amount of water, amount of refluxing,

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* Reg. U. S. Pat. Off.
† Condensed from National Advisory Committee for Aeronautics Research Memorandum 54D01 (May 14, 1954).
‡ Forest Products Laboratory, Madison, Wis.
[1] Numbers in parentheses link to references at end of article, p. 237.

Table I—Effect of Postcure on Joint Strength of 0.064-in. Clad Aluminum-Alloy Lap-Shear Specimens Bonded With FPL-710 Adhesive

Initial cure		Postcure		Shear strength at 600° F.	
Time	*Temperature*	*Time*	*Temperature*	*Average*	*Minimum-maximum*
min.	°F.	*hr.*	°F.	*p.s.i.*	*p.s.i.*
30	320	None		470	80-1160
30	320	3	450	840	540-1290
30	320	192	450	1248	1100-1488

amount and type of solvent, and use of different epoxy and different phenol resins, were also studied to determine their possible effect on the immediate strength of the adhesive bonds at 600° F. Results of some of the more significant studies are given below.

Effect of Postcuring—One fact was well established, namely, that lap joints bonded with FPL-710 and aged for 192 hr. at 450° F. consistently exceeded 1000 p.s.i. in shear strength when tested immediately at 600° F. This, of course, suggested possible advantages in elevated-temperature postcuring of bonds cured initially under conventional conditions. Shear tests of aluminum lap joints at 600° F. have shown that the strength of bonds given a postcure without pressure were significantly higher and more consistent than bonds tested at 600° F. after initial cure only. Table I shows the effect of postcure on joint strength at 600° F. and the variation in joint strength at this temperature of lap-shear specimens of 0.064-in. clad aluminum alloy bonded with FPL-710 adhesive.

Supported Film Adhesive—From previous work it was also known that 0.5-in. lap joints of 0.032-in. clad aluminum alloy made with FPL-710 without postcuring were low in strength at 600° F. (about 150 p.s.i.) when compared with similar bonds of 0.064-in. clad alloy (about 470 p.s.i.). No significant differences were noted in bond strengths on these two metal thicknesses tested at temperatures of 450° F. or lower. In current work a similar effect of the thickness of the metal on the immediate strength of lap joints at 600° F. was observed on bonds of stainless steel. Lap joints of 26-gage (0.016 in.) stainless steel had an average shear strength of 430 p.s.i., while 16-gage (0.061 in.) stainless steel had an average shear strength of 800 p.s.i. at 600° F. This performance of lap joints of metals of different thickness when tested at 600° F. indicated that, since joint strength is apparently closely related to the relative physical properties of the metal and the cured adhesive and to the resultant stress concentrations in the joints under test, the joint strength might be improved appreciably by the use of a supporting fabric in the adhesive bond.

In subsequent tests made on metal lap joints bonded with a tape adhesive composed of a woven glass-fiber cloth impregnated with liquid FPL-710, the immediate strength of joints at 600° F. was materially improved.

Further investigation of various glass-fiber cloths and mats for carriers of the adhesives was undertaken, and the most promising material at the present time appears to be a glass-fiber mat with furfural binder that is approximately 0.010 in. thick (Owens-Corning Fiberglas mat S11Mo1). The use of this mat, impregnated with FPL-710 adhesive to form a dry tape adhesive, has resulted in greater reproducibility and consistently stronger bonds when tested immediately at 600° F. without postcuring as compared with joints made with the liquid adhesive and tested under the same conditions. The joints made with liquid adhesive, however, were higher in shear strength at 600° F. after a postcure than joints made with the mat-tape adhesive. The mat-tape FPL-710 adhesive is also considered to be superior to the liquid adhesive in ease of application, which would be a distinct advantage in a production bonding process, and also develops bonds that are 0.008 to 0.010 in. thick as contrasted with a film thickness of about 0.002 in. obtained with the liquid adhesive.

A comparison of typical average results of tests of lap-shear specimens at −70° to 600° F. bonded with FPL-710 adhesive applied by brush, spraying, and as the impregnated mat described above is shown in Table II. The minimum and maximum failing loads at 600° F. are also given in parentheses in the last column of that table.

Resistance to Heat Aging

As can be seen from Table II, lap joints of clad aluminum alloy properly made with the liquid FPL-710 adhesive applied by brush or spray have shown a high degree of resistance to thermal degradation as indicated by the retention of joint strength at temperatures up to 600° F. after aging for 192 hr. at 450° F. Test specimens aged for 192 hr. at 450° F., and subsequently tested at temperatures from −70° to 600° F., retained half or more of their initial strength at room temperature and had a strength exceed-

Table II—Typical Average Test Results of Lap-Shear Specimens

	Postcure		Average shear strength at test temperature of:			
Application	*Time*	*Temperature*	*−70° F.*	*80° F.*	*450° F.*	*600° F.*[a]
	hr.	°F.	*p.s.i.*	*p.s.i.*	*p.s.i.*	*p.s.i.*
Brush	None	...	1,791	2,776	1,634	470 (80-1,160)
	192	450	1,852	1,740	1,852	1,248 (1,100-1,488)
Spray	None	...	2,480	2,458	1,602	564 (75-820)
	192	450	....	1,810	....	1,634 (1,630-1,640)
Impregnated mat	None	...	1,664	2,692	1,607	900 (610-1,160)
	192	450	1,366	1,497	1,328	1,074 (990-1,140)

[a]Numbers in parentheses give range of strength values for individual specimens.

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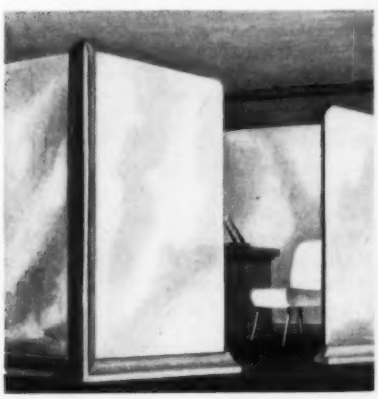

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Table III—Effect of Heat Aging on Shear Strength of Specimens Made With Aluminum Alloy and FPL-710 Liquid Adhesion

Heat-exposure conditions		*Shear strength*
Time	*Temperature*	*at 80° F.*
hr.	*°F.*	*p.s.i.*
None	...	3020
192	450	1980
192	550	350

ing 1200 p.s.i. at each of the temperatures ranging from −70° to 600° F. A study of the performance of this adhesive when aged at temperatures above 450° F. has shown that a considerable loss in strength in joints made with the standard FPL-710 formulation may occur when the temperature is increased to 550° F., as indicated in Table III.

Effect of Amount of Hexamethylenetetramine—Further study of the effect of adhesive composition revealed that the amount of hexa present influenced the resistance of the adhesive to aging for 192 hr. at 550° F. A quantity of 5% hexa based on the combined weight of resin solids of the liquid phenol resin and epoxy resin (4 g. hexa, 100 g. BV 9700, 20 g. Epon 1007) appears to have the greatest resistance to aging for this period as shown in the following data, but further work is needed to determine the optimum amount more accurately:

Amount of hexa	Shear strength at 80° F. after 192 hr. at 550° F.
%	*p.s.i.*
0	290
5	670
7.5	350

Effect of Stabilizers—The cause of the relatively low performance characteristics of adhesive FPL-710 to aging at 550° F. as contrasted with the high performance at 450° F previously cited was investigated further. It was known that 24S-T3 clad aluminum alloy contains approximately 0.1% of copper and 0.7% of combined silicon and iron in the clad face of the alloy. The metals copper and iron, even in very small amounts, are also known to be effective catalysts for the oxidation and degradation of organic materials in many reactions (3) and could be promoting the thermal degradation of adhesive FPL-710 during the exposure for 200 hr. at 550° F. Tests of lap joints of brass bonded with FPL-710 and aged at 550° F. for 200 hr. showed that the adhesive was completely decomposed to a black char after this exposure. This was considered a further indication that the metal, and presumably the copper present in the brass, could have a significant effect on the performance and the resistance of the adhesive to thermal degradation.

In other fields of research, as in hydrocarbon fuels, the deactivation of catalytic metals, particularly copper, has been accomplished by certain chelating agents as described by Watson and Tom (3). These chelating agents have also been used to retard the thermal breakdown in cellulose esters (4). The stability and structure of metal chelate compounds have been investigated by various authors (5, 6). A study of the effect of several potential chelating agents as adhesive stabilizers in the present work revealed that the resistance of FPL-710 adhesive with 5% of hexa to aging for 200 hr. at 550° F. was improved in some cases (Table IV). A quantity of 1% of stabilizer based on the weight of the resin solids of the FPL-710 adhesive was employed and joints were tested at 80° F. after aging 200 hr. at 550° F. The adhesive also contained 5% of hexa.

Several of the chelate stabilizers were particularly promising as agents for retarding the thermal degradation of the adhesive. The materials 8-quinolinol, acetyl acetone, acetonyl acetone, aluminum triacetonyl acetonate, and catechol were most effective and resulted in a retention of 960- to 980-p.s.i. shear strength at room temperature after aging 200 hr. at 550° F. These strength values after aging represent approximately 40% of the control strength at room temperature. Even greater resistance to thermal degradation may be made possible by further work to determine the optimum amounts of hexa and of chelating agent to be employed in the adhesive formulation.

Titanium and Stainless Steel

A limited investigation was made of the liquid adhesive FPL-710 with 5% of hexa for bonding titanium and stainless steel, which are metals with better heat-resistant properties than clad aluminum alloy. This work consisted primarily of ascertaining the effects of various methods of preparing the surface for bonding on the strength properties of the bond and the resistance of these bonds to aging for 200 hr. at 550° F. The results of lap-shear tests at room temperature in this study of metal-surface preparation after an initial cure of 30 min. at 320° F. are shown in Table V., p. 147.

Of these methods, the most effective method of preparing titanium for bonding was immersion in a bath consisting of 9 parts by volume of concentrated nitric acid, 1 part of 50% hydrofluoric acid, and 30 parts of water. The metal was immersed for 20 min. at 120° F., then rinsed and dried. Stainless steel was cleaned most effectively with a solution of 50 parts by weight of concentrated hydrochloric acid, 2 parts of 30% hydrogen peroxide, 10 parts of formalin solution, and 45 parts of water maintained at a temperature of 140 to 150° F. The metal was immersed for a period of 10 minutes. Additional tests were made on similar joints of titanium and stainless steel cleaned by these more effective methods and results are compared with values obtained on joints of clad aluminum alloy prepared by the sulfuric acid, sodium

(*To page* 147)

Table IV—Effect of Various Stabilizers on Heat Aging of FPL-710 Adhesive

Stabilizer	*Shear strength at 80° F. after 200 hr. at 550° F.*
	p.s.i.
None	670
8-Quinolinol	960
Salicylic acid	890
Salicylaldehyde	785
Acetyl acetone	985
Acetonyl acetone	965
Aluminum triacetonyl acetonate	960
Catechol	980
Gallic acid	820
o-Aminophenol	320
Ethylenediamine	835
Oxalic acid	120
Mucic acid	480
Tartaric acid	320
Copper citrate	480
Triethanolamine titanate	440

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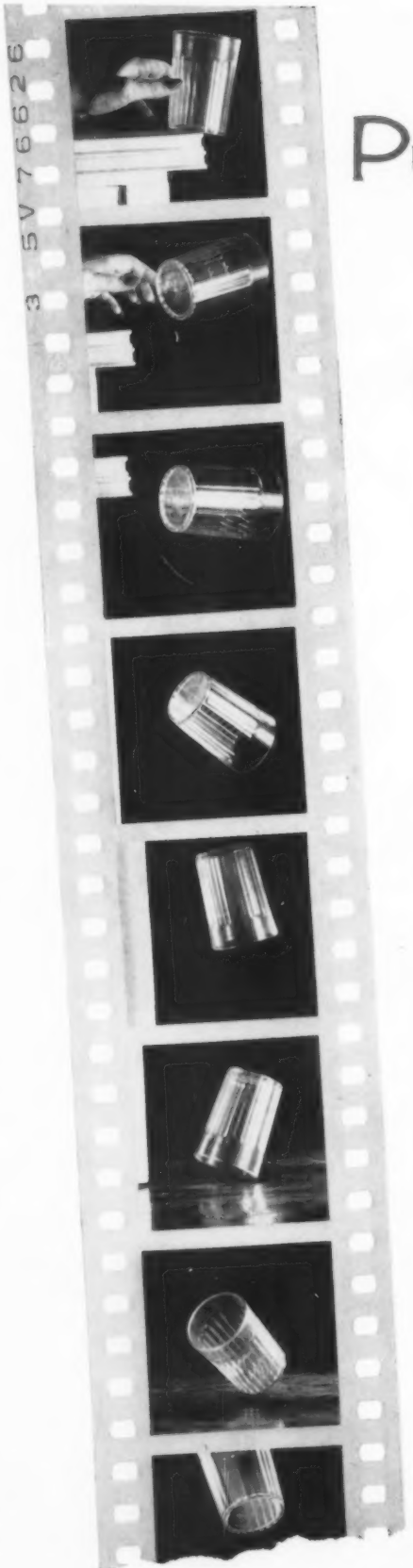

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Table V—Effects of Cleaning Methods on Bonding of Titanium and Stainless Steel With FPL-710 Adhesive

Metal	*Method of cleaning*	*Shear strength at room temperature*
		p.s.i.
Titanium RC-30, ½ hard, 0.032 in. thick	Sulfuric acid, sodium dichromate bath	825
	Nitric acid, hydrofluoric acid bath	2020
Stainless steel, type 302, annealed, 26 gage	Sulfuric acid, sodium dichromate bath	1840
	Abraded with emery cloth	2235
	Wiped with lacquer thinner	1740
	Metasilicate degreased	1760
	Hydrochloric acid, peroxide, formalin bath	2680

Table VI—Shear Strength of Titanium and Stainless-Steel Lap Joints Compared with That of Aluminum-Alloy Joints

Metal	*Metal thickness*	*Heat-exposure conditions,*		*Shear strength at test temperature of:*		
		Time	*Temperature*	*−70° F.*	*80° F.*	*600° F.*
	in.	*hr.*	*°F.*	*p.s.i.*	*p.s.i.*	*p.s.i.*
Titanium RC-30	0.032	None	....	980	2,020	....
		192	550	....	48	....
Stainless steel, type 302	0.016	None	....	2,540	2,680	430
		192	550	....	1,490	....
Aluminum 24S-T3	0.064	None	....	1,791	2,776	470
		192	550	....	670	....

dichromate process tested under similar conditions in the summary compiled in Table VI.

These data revealed several interesting phenomena. The bonds of FPL-710 adhesive on titanium showed practically no resistance to aging at 550° F. and were almost completely charred after 192 hr. of exposure. This loss in resistance to aging at 550° F. may have been caused by the method of preparing the titanium surfaces for bonding, which employed a mixture of nitric and hydrofluoric acids, but further work is needed to explain this behavior of the adhesive more fully. The resistance of FPL-710 to aging at 550° F. in bonds of stainless steel, on the other hand, was particularly good and exceeded that obtained on bonds of aluminum. The bonds of stainless steel were also outstanding in their performance at −70° F., where there was no appreciable loss in shear strength from that obtained in tests that had been conducted at room temperature.

These limited tests on the different metals have revealed that the type of metal, the method of preparation for bonding, and presumably the mechanical properties of the metal at various test conditions have a major effect on the performance of the adhesive in elevated-temperature exposures. A more extensive study of metal bonding along these lines is needed and may be very helpful in formulating metal bonding adhesives which possess improved performance characteristics as compared with currently used compounds.

Other Phenol Resins

In the course of the study of variables affecting the performance of adhesive at 600° F., two additional phenolic resins, Durez 15956 and Durez 16227, were evaluated as replacements for the same amount of Bakelite BV 9700 in the liquid form of FPL-710 and appeared to be quite promising. When either of these phenol resins was employed with Epon resin 1007 without additional curing agents applied by brushing, joint strength when tested immediately at 600° F. was slightly higher than that obtained with FPL-710 and test results showed greater consistency in three separate series of tests than had been observed with FPL-710 when used in liquid form.

These resins were also promising because of the resultant improved flow properties in the mixed adhesive in the uncured state over those made with Bakelite BV 9700, presently employed in FPL-710. This greater degree of flow resulted in a film from which it was apparently less difficult to remove solvent and air before curing. Moreover, flow was improved at a lower pressure during bonding, without reducing the subsequent heat resistance of the cured bond. The bond strength at room temperature of the adhesive employing these resins, however, was lower than that of FPL-710, and bonds also appeared to be more brittle than those made with FPL-710. The over-all properties of the adhesive formulations with these resins were, therefore, probably no more promising than the adhesive FPL-710.

Reduction of Brittleness

A number of studies were directed toward reducing apparent brittleness of the cured adhesive bonds of liquid FPL-710 in lap joints of 24S-T3 clad aluminum alloy by incorporating rubbers or other elastic materials into the phenol-epoxy resin formulations. In these studies the brittle properties and apparent resistance to peel were determined qualitatively in lap-shear test specimens by observing the behavior of the bonds in 0.064-in. aluminum when the panels were handled, cut into individual specimens, and tested, as well as by breaking open lap joints of 0.032-in. clad aluminum by hand and applying the bend test described in reference 2. No experiments were conducted relative the peel resistance of specimens with a sandwich-type construction.

Investigations to reduce the brittleness and improve peel properties

(*To page* 237)

Time, Temperature, and Rupture Stresses in Reinforced Plastics*

by S. GOLDFEIN†

Proposed utilization of laminates fabricated from polyester resins reinforced with glass fibers in Corps of Engineers equipment that must sustain appreciable loads over relatively long periods of time has led to the investigation of the relationship between time, temperature, and rupture stresses in these materials. It was found that a time-temperature relationship developed for the study of rupture stresses in metals at elevated temperatures could be applied to these materials with considerable success. Application of this relation allows the use of short-time tests at elevated temperatures to determine long-time data at room temperature and permits the presentation of the complete rupture characteristics of a laminate on a single curve.

MATERIALS fabricated from polyester resins reinforced with glass fibers have many desirable properties, foremost of which are their great specific strength and ease of handling. It is not surprising, therefore, to find that they are being used in items where only metals were considered heretofore. The Engineer Research and Development Laboratories at Fort Belvoir, Va., have been investigating the use of these laminates in such items as pontoons, pipes for petroleum distribution, hot and cold water pipes, compressed gas cylinders and the like. Several of these items are currently under development. A number of them will operate under conditions of high temperature and stress for long periods of time once they are put into use.

Although there is an abundance of design information available regarding the properties of these materials, practically all of the data were obtained from tests that ran their course in a few minutes. Since the strengths of these materials are time-temperature dependent, short-time laboratory tests do not portray a complete picture of their capabilities. The purpose of this study was to investigate the relationship between time, temperature, and rupture stresses for these reinforced plastics laminates.

A search of the literature disclosed only one pertinent report (1).[1] Stresses required to rupture plastics at various temperatures and rates of creep over periods of time up to 1000 hr. were reported. The plastics were laminates fabricated from Plaskon 920, Stypol 16B, and Selectron 5003, reinforced with Fiberglas 181-114. Unfortunately, the value of the work was limited to the stresses, temperatures, and periods of time used to perform the tests.

Stress-Time-Temperature Equations

An equation that related ultimate strengths to the duration of application of stress would be very useful. Several of these have been devised but are either too cumbersome or complicated, or contain constants or other factors difficult to determine. They are based on rate-process theories and take the same general form:

$$t = Be^{EU/SRT} \qquad \text{Eq. 1}$$

where t = time for fracture, B = constant, e = natural logarithm, E = Young's modulus, U = activation energy, S=ultimate tensile strength, R = gas constant, and T = absolute temperature, and:

$$r = Ae^{-QS/RT} \qquad \text{Eq. 2}$$

where r = rate, A = constant, and QS = activation energy for the process.

Holloman and Jaffe (2) have shown that the relation between tempering time and temperature for a given hardness derived from equation 2 is expressed by the follow equation:

$$T(C+\log t) = \text{constant} \qquad \text{Eq. 3}$$

Since both creep and tempering seem to obey rate-process laws, it was believed that this concept should be directly applicable in creep and rupture testing for the purpose of shortening the test time.

Larson and Miller carried this relationship one step farther (3). They showed that for a given stress in steel and other metals the time to rupture is related to temperature by the equation:

$$T(20+\log t) = K \text{ (constant)} \qquad \text{Eq. 4}$$

where T = absolute temperature, expressed in degrees Rankine, and t = time, hr.

Their master curves for rupture stress versus K were plotted on semilogarithmic paper. These covered a temperature range from 500 to 1900° F. Examination of the curves revealed that the deviation of points from a single curve was small and was probably due to experimental errors. Application of this relation allowed the use of short-time tests to determine long-time data with remarkable accuracy. The value of 20 for *C* in equations 3 and 4 was developed both empirically and by derivation. An examination of the derivation showed that *C* for all intents and purposes was a constant almost independent of material. Thus, it was conceivable that the formula would be applicable to plastic materials.

Stress-Time Relationships

The K values were calculated for all the laminates listed in the Air Force report (see Table I, page 150); time versus rupture stress curves were drawn on semilogarithmic graph paper (see Figs. 1 to 6, page 150); rupture stress versus K

* Presented at the 1954 Annual Meeting of the American Society for Testing Materials in Chicago, and scheduled for publication in the 1954 A.S.T.M. Proceedings.

† Engineer, Research and Development Laboratories, Corps of Engineers, U. S. Army, Fort Belvoir, Va.

[1] Numbers in parentheses refer to references at end of this paper, p. 238.

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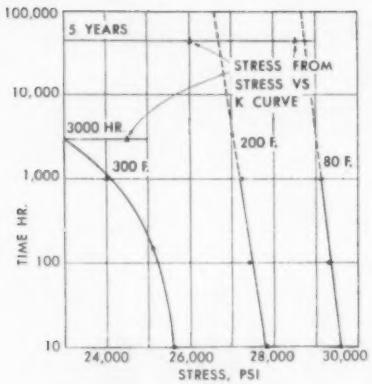
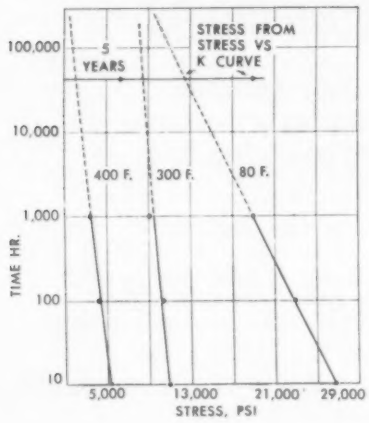


Fig. 1 (above)—Stress to produce tension rupture in Plaskon 920 laminates

Fig. 2 (below)—Stress to produce compression rupture in Plaskon 920 laminates

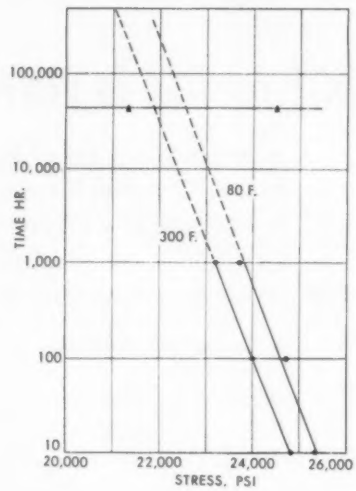


curves were then plotted on semilogarithmic paper (Figs. 7 and 8, page 151). Stresses required to rupture the laminates at various temperatures in 5 yr. were determined by two methods. First, the K values were calculated, using the appropriate values for the temperatures and time. The stresses were then noted on the rupture stress versus K curve. Secondly, the time versus rupture stress curves were extrapolated to a time of 5 yr. and the corresponding stresses noted (Table II, p. 151).

The stresses to rupture in 5 yr., as determined by both methods, were found to be in close agreement (within 10%), with the exception of the results obtained from compressive tests on Plaskon 920 laminates. The latter were off approximately 20% at 80° F. and 37% at 300° F. All the rupture stress versus K curves appeared to have the same general shape, with the exception of the compression curves for Plaskon 920 and Selectron 5003 laminates. The latter two curves have irregular shapes including abrupt changes in slope. There were insufficient data to draw these curves with any degree of accuracy.

Examination of the Larson-Miller rupture K curves for steel alloys revealed that they possessed one or

Fig. 3 (below)—Stress to produce tension rupture in Stypol 16B laminates



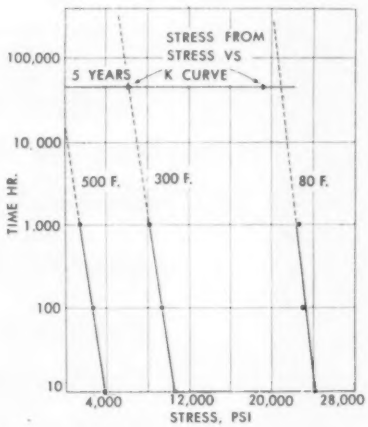


Fig. 4 (above)—Stress to produce compression rupture in Stypol 16B laminates

Fig. 5 (below)—Stress to produce tension rupture in Selectron 5003 laminates

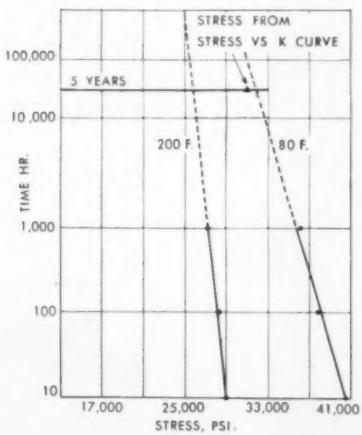


Table I—Stress to Rupture Laminates and *K* Values

Resin and type of stress	*Temperature*	*Stress to produce rupture in 10 hr.*	$K \times 10^{-3}$	*Stress to produce rupture in 100 hr.*	$K \times 10^{-3}$	*Stress to produce rupture 1000 hr.*	$K \times 10^{-3}$
	°F.	p.s.i.		p.s.i.		p.s.i.	
Plaskon 920							
Tension	80	29,600	11.3	29,300	11.9	29,100	12.4
	200	27,800	13.8	27,400	14.5	27,200	15.2
	300	25,600	16.0	25,100	16.7	24,000	17.5
	400	25,400	18.0	21,000	18.9	14,400	19.8
Compression	80	26,800	11.3	23,000	11.9	19,000	12.4
	300	11,000	16.0	10,500	16.7	9,200	17.5
	400	5,300	18.1	4,400	18.9	3,500	19.8
Stypol 16B							
Tension	80	25,300	11.3	24,700	11.9	23,700	12.4
	300	24,800	16.0	24,000	16.7	23,200	17.5
	500	16,000	20.2	12,000	21.2	5,300	22.2
Compression	80	24,200	11.3	33,000	11.9	22,600	12.4
	300	10,700	16.0	9,400	16.7	8,100	17.5
	500	3,800	20.2	2,700	21.2	1,400	22.2
Selectron 5003							
Tension	80	40,700	11.3	37,800	11.9	36,300	12.4
	200	28,900	13.8	28,200	14.5	27,300	15.2
Compression	80	27,500	11.3	26,000	11.9	24,800	12.4
	200	7,200	13.8	6,000	14.5	4,900	15.2

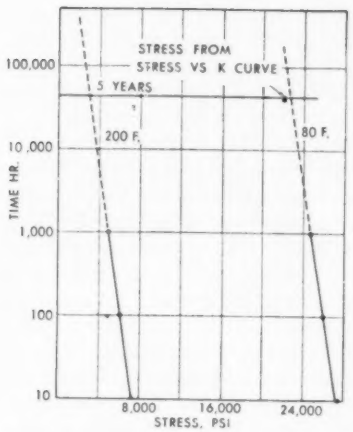


Fig. 6—Stress to produce compression rupture in Selectron 5003 laminates

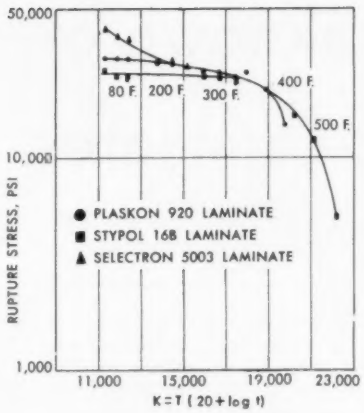


Fig. 7—Stress to produce tension rupture versus K for three laminates

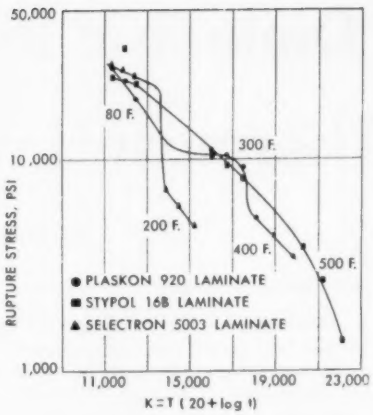


Fig. 8—Stress to produce compressive rupture versus K for three laminates

more sharp breaks similar to the Plaskon 920 and Selectron 5003 compression curves. Breaks in the alloy curves were attributed to important changes in the flow and fracture process.

The rupture as well as creep behavior of high polymers, especially laminates, are generally less predictable than those of metal because of a number of complicating factors. Barring such conditions, the breaks would probably represent abrupt changes in the relaxation mechanisms.

Other Applications

The rupture stress versus K curves might be used for purposes other than those described. For instance, impact strengths have been determined by the Izod impact test and by dropping balls on plates. The former may be considered a flexural-impact test and the latter a compression-flexural impact test. The time of application of load may be considered to be approximately 0.03 second. At 73° F., the K value would be 7900. Thus, the impact stress induced in a material due to a sudden blow might be determined by consulting the appropriate rupture stress versus K curve at a K value of 7900. The stress, of course, would vary with variations in temperature and such variations must be taken into consideration.

The effect of low as well as high temperatures on the strengths might be determined from the curves. As the temperature decreases, K decreases (see equation 4). Examination of Figs. 7 and 8 shows an increasing slope with a decreasing K, indicating an increase in strength with a decrease in temperature. This is in accordance with the results obtained with these materials by the National Bureau of Standards of the U. S. Department of Commerce and the Bureau of Ships in investigations which have been conducted in their laboratories.

The upper practical limit of the curve for the metals was the temperature at which surface oxidation took place. The corresponding limit for the plastics would probably be the temperature at which thermal decomposition of the plastic material commences.

Master Creep Curves

No mention has been made regarding master creep curves, although the Larson-Miller paper indicated that the creep curves for steel were similar to the rupture curves. Preliminary calculations and

(*To page* 238)

Table II—Time to Rupture Laminates Calculated From *K* Values

Resin and type of stress	*Temperature*	*Time*	$K \times 10^{-3}$ *(calculated)*	*Stress, from stress versus K*	*Stress, from extrapolating time versus stress curve*	*Difference*
	°F.	hr.		p.s.i.	p.s.i.	%
Plaskon 920						
Tension	80	43,800 (5 yr.)	13.35	28,500	28,700	−0.7
	200	43,800 (5 yr.)	16.25	26,000	26,650	−2.4
	300	3,000	17.45	24,500	23,000	+6.5
	400	43,800	21.20	....	....	....
Compression	80	43,800	13.35	14,100	11,800	+19.5
	300	5,000	18.00	5,400	8,500	−36.5
	400	....	21.20	....	....	....
Stypol 16B						
Tension	80	43,800	13.35	24,500	22,550	+8.7
	300	43,800	18.75	21,300	21,850	−2.5
	500	43,800	22.65	....	....	....
Compression	80	43,800	13.35	19,200	21,000	−8.6
	300	43,800	18.75	6,150	6,150	0
	500	....	23.65	....	....	....
Selectron 5003						
Tension	80	43,800	13.35	31,000	31,800	−2.6
	200	....	16.25	....	....	....
Compression	80	....	13.35	22,000	22,600	−2.7
	200	....	16.25	....	....	....

Dielectric Breakdown of Thermosetting Laminates*

by N. A. SKOW†

Thermosetting laminated plastics are used extensively for electrical insulation because of their unusual combination of electrical, mechanical, and chemical properties. Excellent electrical insulators, these materials are also mechanically strong, light in weight, and easy to fabricate. They resist chemical corrosion, moisture, aging, and heat deterioration. To establish safe operating loads, tests for the endurance limits of dielectric strength were run on each of several grades of thermosetting plastic laminates plotting voltages against time. The data thus obtained indicate that for a given thickness and atmospheric condition, a maximum voltage exists below which failure will not occur. Tests of this type yield results that are valuable to the design engineer in determining the proper grade and thickness of material for use as insulating parts in electrical equipment.

IN SELECTING an electrical insulating material, the designer is primarily concerned with insulation resistance, dielectric loss, and dielectric breakdown. The relative importance of these various properties depends on the application involved, but dielectric breakdown is almost always a major consideration in deciding on a material.

As defined by A.S.T.M., the dielectric strength of an insulating material is the maximum potential gradient that the material can withstand without rupture. It is difficult to evaluate quantitatively because its magnitude varies with temperature, thickness of material, moisture content, and time exposed to stress. In general, the dielectric strength of insulating materials decreases with time of exposure to the electrical stress.

For a quick determination of dielectric strength, the short-time test has been devised. For fairly rapid determinations, but laying more emphasis on the time factor, the step-by-step test has been arranged. These tests involving short exposures are primarily comparative and are not indicative of the breakdown of the materials under prolonged exposure to lower stresses. The limitations of these tests have been pointed out in the appendix to the A.S.T.M. Standards on Electrical Insulating Materials.[1]

Since long service without breakdown is a primary requirement of electrical insulating materials, determination of the endurance limit is most essential. This can be measured by stressing the laminate with voltages less than the short-time value and recording the results at each voltage. When the maximum voltage that can be applied for an indefinite time without breakdown has been found, the endurance limit of dielectric strength has been established.

Differences between the dielectric breakdown properties of thermosetting laminates stressed parallel to laminations and those stressed perpendicular to laminations are sufficient to warrant investigation of behavior for each direction. The same dielectric strength and endurance characteristics do not exist where laminated sheets are used as insulating spacers (stressed perpendicular to lamination), and where laminates are used as terminal-board insulators (stressed parallel to lamination).

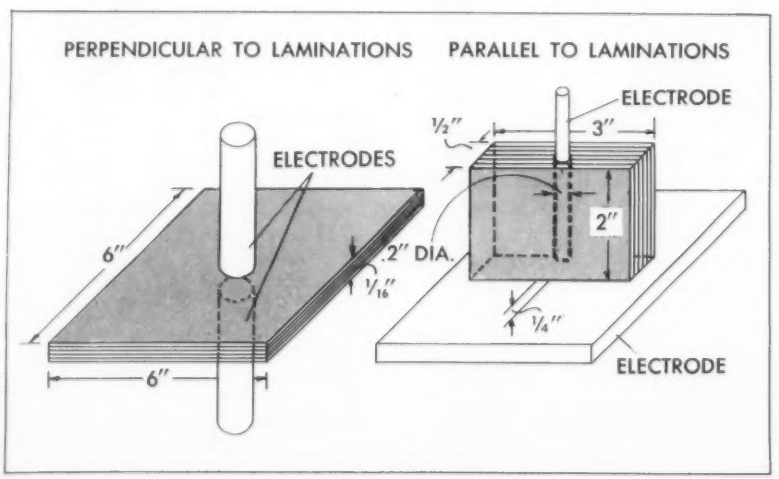
Grades Tested

To obtain the results presented here, seven standard N.E.M.A. grades of laminated thermosetting plastics were tested: Grades X, XX, XXXP, LE, A, G-5, and N-1. Any other N.E.M.A. grade might be used in similar applications but those mentioned were selected because they are typical of the entire group. While this series of tests was made only upon laminates in the sheet form, the dielectric properties of tubes, rods, and molded parts are quite similar.

Grades X, XX, and XXXP are paper-base laminates bonded with phenolic resin. Grade X is intended primarily for mechanical applications and should be used with discretion under high-humidity conditions. Grade XX is made with a more

[1] Published by American Society for Testing Materials, 916 Race St., Philadelphia, Pa.

Fig. 1—Specimen sizes and test arrangement for determining dielectric breakdown parallel and perpendicular to laminations in thermosetting laminates. (Electrodes perpendicular to laminations are not drawn to scale. Actually they are 2 in. in diameter)



* Presented at the Semi-Annual Meeting of the American Society of Mechanical Engineers in Pittsburgh, Pa., in June 1954.
† Director of Research, Synthane Corp.

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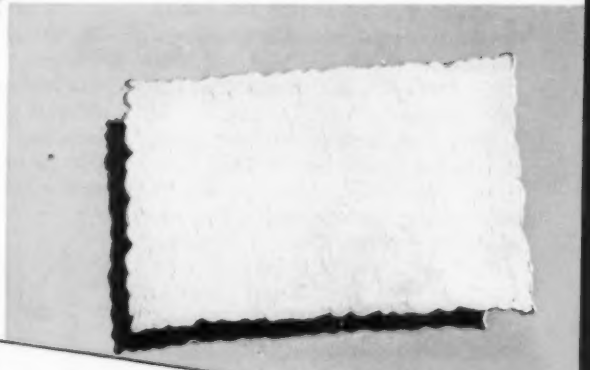

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Table I—Effect of Temperature on Dielectric Strength (Short-Time) of Laminates

	Dielectric Strength (Short-Time)					
	Grade XX		Grade XXXP		Grade N-1	
Temperature	Perpendicular[1]	Parallel[2]	Perpendicular[1]	Parallel[2]	Perpendicular[1]	Parallel[2]
°F.	v./mil	v./mil	v./mil.	v./mil	v./mil	v./mil
65	700	154	900	160	520	240
77	484	150	850	156	498	228
91	416	156	825	160	486	224
100	339	158	800	158	483	220
121	282	144	775	154	480	204
139	240	140	778	152	455	180
170	160	140	750	146	317	140
184	138	142	743	144	275	132
202	120	128	719	150	213	104
210	103	120	675	140	170	92
226	99	116	500	132	155	72
236	87	108	490	136	145	60
244	86	104	—	129	140	52
256	82	—	—	148	134	—

[1] Average for five specimens conditioned for 1 hr. at 220° F.
[2] Average for five specimens conditioned for 8 hr. at 220° F.

absorbent paper and has a higher resin content than Grade X. Grade XX is better electrically, although slightly weaker mechanically, than Grade X. Grade XXXP, which has a still higher resin content, is one of the best electrical laminates produced. Grade LE has a cotton fabric base and is bonded with phenolic resin. This grade is used on electrical applications requiring greater toughness than is provided by Grade XX.

Grade A is an asbestos paper-base laminate bonded with phenolic resin. It is more flame and heat resistant than the cellulosic grades. Bonded with melamine resin, Grade G-5 is a glass-base laminate with very high mechanical strength, excellent electrical properties under dry conditions and good heat, flame, and arc resistance. Grade N-1 is a nylon fabric-base laminate bonded with phenolic resin. It has excellent electrical and mechanical properties even under high humidity conditions.[2]

Program of Tests

Figure 1, p. 152, shows the specimen size and test arrangements used to determine dielectric strength and endurance limit of plastic laminates in both directions (perpendicular and parallel to laminations). For testing perpendicular to laminations, 6- by 6-in. specimens were selected at random from standard production sheets (36 by 36 by 1/16 in.). For the tests parallel to laminations, specimens 2 by 3 by ½ in. were cut from standard sheets 36 by 36 by ½ inch. A 0.2-in. diameter hole was drilled along the 2-in. axis of each specimen to a depth of 1¾ inch. The end of each hole was counterbored with a flat bottom drill, leaving a ¼-in. thickness of laminate between the bottom of the hole and the edge of the sample. While this is not a standard test specimen, it was found very convenient in this study because it eliminated the problem of flashover. (To have used a specimen 6 by 6 in. would have meant the production of a 6 in. thick sheet of laminate for each grade to be tested.)

Short-time dielectric strength measurements perpendicular to laminations were made on the 6- by 6- by 1/16-in. specimens in oil as specified in A.S.T.M. Standard D 149-44. The specimens to be tested were first dried in an oven at 220° F. for 1 hr. and then cooled in a desiccator for 16 hr. at 73° F. After conditioning, tests were made using five specimens of each grade.

Short-time dielectric strength measurements parallel to laminations were made on the 2 by 3 by ½-in. specimens in oil. Because of the thickness of the specimens, these test pieces were conditioned at 220° F. for 8 hr., followed by 16 hr. of cooling in a desiccator at 73° F. Five specimens of each grade were tested.

Dielectric Strengths

Results of tests in both directions are given in Table I for Grades XX, XXP, and N-1 at temperatures from 65 to 256° F. Breakdown voltage versus temperature curves are given in Fig. 2 for both perpendicular and parallel directions for each of the three grades tested. Two significant facts are readily apparent: 1) short-time dielectric strengths parallel to laminations are lower than those perpendicular to laminations (with the exception of Grade XX at temperatures above 180° F.); and 2) the difference in dielectric strength versus temperature characteristics parallel to laminations are comparatively small.

Grade XXXP laminate has the highest dielectric strength perpendicular to laminations within the temperature range covered, and the

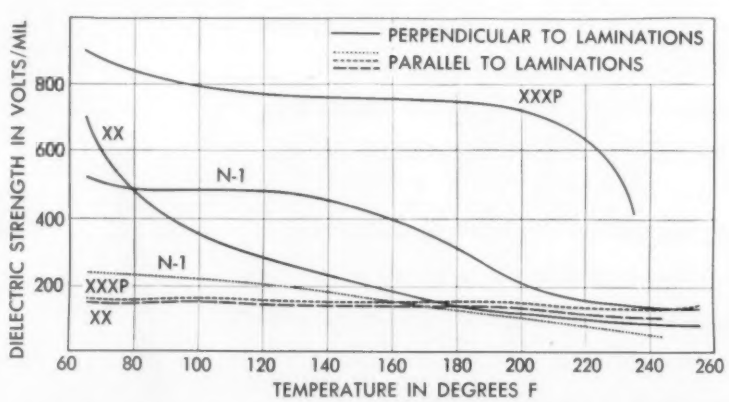

Fig. 2—Effect of temperature on dielectric strength (short-time) of laminates

[2] For a description of the N.E.M.A. grades not included here see "Standards for Laminated Thermosetting Products," publication No. LP1-1951 of the National Electrical Manufacturers Assoc.

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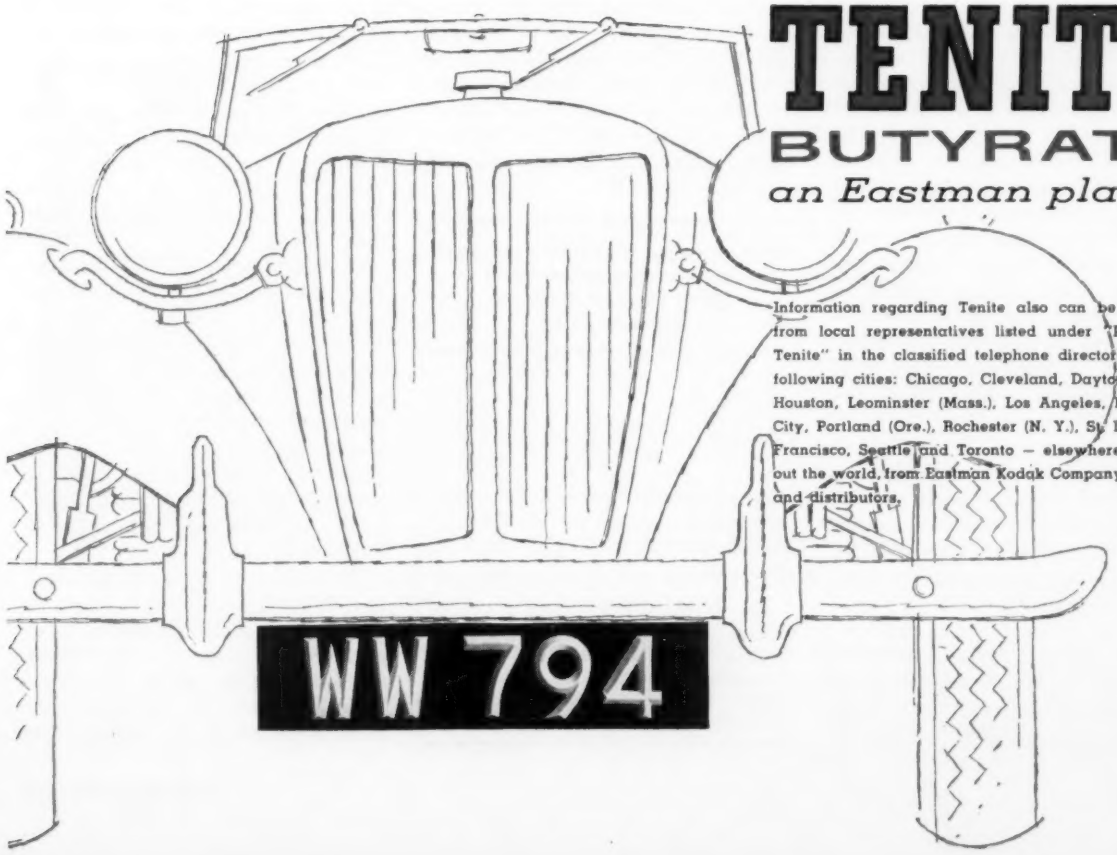

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drop in breakdown voltages is very small between 90 and 180° F. This gradual change in breakdown voltage up to 180° F. is of particular advantage when laminated plastic components are subjected to hot-spot temperatures in electronic equipment. It is evident that there is a rapid decrease in the breakdown voltage of even Grade XXXP as the temperature is increased further. The breakdown characteristics of the three grades parallel to laminations are more nearly equal. This indicates that it makes little difference in regard to short-time dielectric strength which of the three grades is selected for operation at temperatures within the range covered.

The data in Table I indicate that parallel to laminations Grade N-1, nylon-base laminate, has the most rapid decrease in dielectric strength (short-time) with temperature, while the breakdown voltages of Grade XXXP, although it has a lower dielectric strength at lower temperatures, drop slightly between 65 and 256° F. The breakdown voltages of Grade XX appear between these two extremes throughout the temperature range.

Data in Table II are presented to indicate the effect of sample thickness on the short-time dielectric strength measured in both directions. The dielectric strength of Grade XX laminate measured perpendicular to lamination is 515 v./mil at a ⅛-in. thickness or slightly more than half the magnitude for a 1/32-in. sample thickness. The dielectric strengths parallel to laminations, measured at five thicknesses ranging from 1/16 to ½ in., are very close for Grades X and XX with sample thicknesses greater than ⅛ inch. In Table II, the decrease in dielectric strength may be compared to the law of diminishing returns in that each additional thickness of laminate provides a smaller increase in the total dielectric breakdown voltage of the sample.

Table II shows the necessity for maintaining equal sample thicknesses for all tests to obtain results for the purpose of comparison. For measurements perpendicular to laminations throughout this testing program, a thickness of 1/16 in. was selected because it is representative of the sheet thicknesses used in many electrical applications. A ¼-in. thickness was specified for testing parallel to laminations because thinner sections presented greater difficulties to machine to uniform dielectric gaps.

Table II—Effect of Specimen Thickness on Dielectric Strength (Short-Time) of Laminates: Tested dry at 73° F.

	Dielectric Strength (Short-Time)		
	Perpendicular to Laminations[1]	*Parallel to Laminations*[2]	
Thickness	*Grade XX paper-base*	*Grade X paper-base*	*Grade XX paper-base*
in.	*v./mil*	*v./mil*	*v./mil*
1/32	940	—	—
1/16	695	360	530
⅛	515	270	275
¼	—	160	180
⅜	—	120	130
½	—	110	120

[1] Average for five specimens, conditioned for 1 hr. at 220° F.
[2] Average for five specimens, conditioned for 8 hr. at 220° F.

Effects of Conditioning

To determine the effects of conditioning, the dielectric strength (short-time) of Grade XX laminate was measured in both directions for various combinations of time, temperature, and moisture treatment. The results of these tests are given in Table III for each specified conditioning treatment. Conditioning for a maximum of four days for measurements perpendicular to laminations was sufficient, but 21 days were necessary to insure uniform moisture absorption for obtaining breakdown voltages parallel to laminations. Because dielectric strength varies widely with changes in conditioning treatment, considerable care was taken to standardize the sample conditioning prior to dielectric strength tests. One hour drying at 220° F. was selected for samples to be tested perpendicular to laminations because under these testing conditions the most reproducible results were obtained.

Table III—Effect of Conditioning Treatment on Dielectric Strength (Short-Time) of Grade XX Tested at 73° F.

Conditioning Treatment	*Dielectric Strength*[1] *(Short-Time)*
	v./mil
Perpendicular	
1 hr. in oven at 220° F.	690
96 hr. at 90% R.H. and 95° F.	240
48 hr. in H_2O at 122° F.	112
Parallel	
21 days in desiccator at 73° F.	180
21 days at 90% R.H. and 73° F.	100
21 days in H_2O at 73° F.	40

[1] Average for five specimens

These samples were removed from the conditioning chamber, placed between the electrodes of the testing equipment, and immersed in an oil bath. As far as possible, the samples of each grade of laminate were tested at 85, 70, 60, 55, 50, and 45% of the short-time breakdown voltage measured previously. Voltage was applied at the rate of 10 kv./sec. until specified magnitude was reached and maintained until rupture occurred. The voltage applied and the time in minutes required for failure were then recorded.

Measurements parallel to laminations were made in oil with a metal pin and plate as electrodes (Fig. 1). All samples were conditioned in an oven for 8 hr. at 220° F. and five specimens of each grade were tested for short-time dielectric strength in accordance with A.S.T.M. D 149-44. Because of the ¼-in. thickness of the electrode gap, a longer conditioning period was necessary to insure uniform dryness.

The endurance limit of the dielectric strength parallel to laminations was determined by applying voltages at the rate of 10 kv./sec. until 85, 70, 60, 55, 50, and 45% of the short-time breakdown value was reached. After rupture occurred, the voltage and

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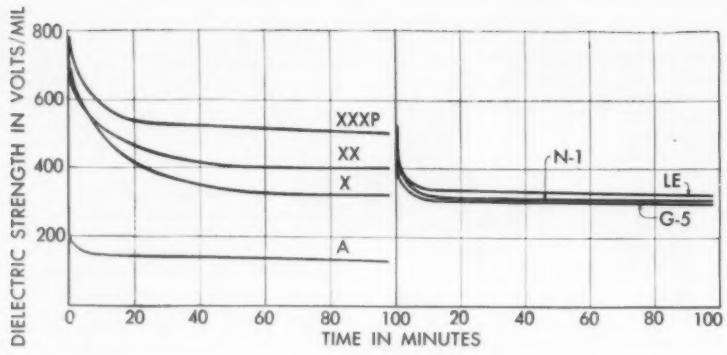

Fig. 3—Endurance limits of the dielectric strength perpendicular to laminations

time for failure were recorded. For all tests, the samples and testing procedure were made as uniform as possible.

Endurance Limits

The dielectric endurance limits, perpendicular to laminations, for the seven grades of laminates tested are given in Fig. 3. The dielectric strength of all grades of laminates decreases quite rapidly with time until it is approximately 60 to 70% of the short-time dielectric strength. The curves show that the breakdown voltage, or upper limit of voltage gradient without rupture, gradually approaches a magnitude that is independent of time. The endurance limit of the material is considered approximately equal to the maximum dielectric strength that will not rupture after a 100-min. exposure to stress. This assumption is based on tests on five samples which, after resisting breakdown for 100 min., continued to withstand the applied stresses for 18 hours.

Short-time dielectric strengths and endurance-limit values are compared in Table IV. In part A, where the seven grades of laminates are tested dry at 73° F., the ratios (percent) of endurance limits to short-time dielectric strength are tabulated (data from curves in Fig. 3) to indicate the relative characteristics of the seven grades. Grade A, asbestos-base plastic laminate, has the lowest dielectric strength and endurance limit in either direction but is recommended in high temperature applications because of its superior heat resistance. The six remaining grades tested are suitable for high-voltage applications, Grade XXXP

(To page 240)

Table IV—Short-Time Dielectric Strengths and Endurance Limits of Laminates Tested at 73° F.

			Perpendicular to Laminations					*Parallel to Laminations*		
	Grade	*Thickness*	*Short-Time Diel. Str.*	*Endurance Limit*	*Endurance Limit × 100 / Short-Time Diel. Str.*	*Grade*	*Thickness*	*Short-Time Diel. Str.*	*Endurance Limit*	*Endurance Limit × 100 / Short-Time Diel. Str.*
			v./mil	*v./mil*				*v./mil*	*v./mil*	
A	X	1/16 in. Thick Dry	649	320	49.3	X	1/4 in. Thick Dry	124	92	74.2
	XX		695	390	56.1	XX		176	108	61.3
	XXXP		780	500	64.2	XXXP		172	124	72.0
	LE		434	320	73.8	LE		206	134	65.0
	A		155	130	83.8	A		48	36	75.0
	G-5		450	310	68.9	G-5		144	100	69.4
	N-1		394	305	77.4	N-1		240	180	75.0
B	XX	1/16 in., 96 hr. at 90% R.H. 95° F.	240	150	62.5	XX	1/4 in., 21 days at 90% R.H. 30° C.	100	80	80.0
		1/16 in., 48 hr. in H_2O at 122° F.	112	55	49.5		1/4 in., 21 days in water at 50° C.	38	18	47.4
C	XXXP	1/16 in., 96 hr. at 90% R.H. 95° F.	700	400	64.2	XXXP	1/4 in., 21 days at 90% R.H. 30° C.	112	96	85.7
		1/16 in., 48 hr. in H_2O at 122° F.	680	375	57.2		1/4 in., 21 days in water at 50° C.	56	28	50.0

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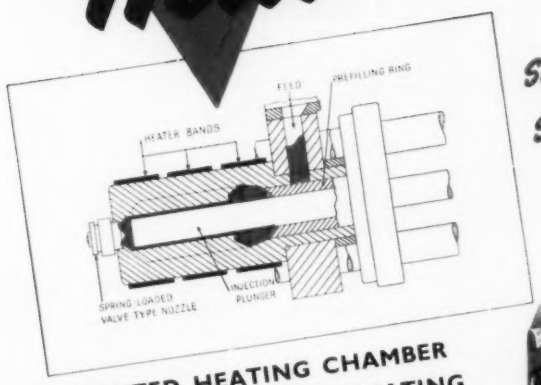

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

SELECTED PLASTIC REFERENCES FOR THE MECHANICAL ENGINEER—1952-1953. P. O. Powers, F. W. Elliott, J. K. Stevenson, K. E. Jackson, and J. R. Kelly. Mech. Eng. *76*, 659-63 (Aug. 1954). The plastics literature of 1952-53, with emphasis on the engineering aspects of plastics, is covered by 228 selected references dealing with materials, properties, fabrication, applications, laminated and reinforced plastics, coatings, and reviews.

CRYSTALLIZATION PHENOMENA IN FIBER-FORMING POLYMERS. L. B. Morgan. J. Appl. Chem. *4*, 160-72 (Apr. 1954). The present position reached in a general study of how fabrication conditions affect the crystalline texture and, therefore, the properties of crystalline polymers is reviewed. The mechanism by which long-chain molecules arrange themselves into some form of crystalline order is postulated to be one involving normal nucleation processes but modified to take account of the fact that polymers melt over a range of temperatures and the nucleation act is followed by preferential crystal growth in the direction of the polymer chains. It is considered that lateral accretion of the polymer molecules to the already formed long helical polymer-crystal results in haphazard branching growth with the new fibril developing along a path parallel to the parent crystal.

Materials

FLAME-RESISTANT POLYESTERS FROM HEXACHLOROCYCLOPENTADIENE. P. Robitschek and C. T. Bean. Ind. Eng. Chem. *46*, 1628-32 (Aug. 1954). Conventional polyester resins based on phthalic anhydride when used by themselves or in conjunction with glass fiber reinforcement show considerable flammability, which increases sharply with reduction in thickness. While the flammability is comparable to that of many woods, the substantially superior mechanical strength of polyester glass plastics permits, from the mechanical point of view, unusually slender designs. However, such structures may be highly flammable. Introduction of suitable chlorinated compounds into polyester resins results in lowering of flammability. If flame-proofing compounds are introduced as plasticizers or extenders, they weaken the resins and are of doubtful permanence. Experimental results are presented that indicate that the diene reaction adduct of hexachlorocyclopentadiene with maleic acid may be utilized as a major constituent in the synthesis of polyester resins that are unusually flame resistant, particularly in the presence of a small proportion of antimony oxide. A number of new difunctional derivatives of hexachlorocyclopentadiene are suitable for the synthesis of polyester resins of similar but modified properties. A comparison with essentially equivalent resins made from phthalic anhydride and tetrachlorophthalic anhydride illustrates the superior flame resistance and heat resistance of the new compositions.

DRAWING OF TERYLENE. I. Marshall and A. B. Thompson. J. Appl. Chem. *4*, 145-53 (Apr. 1954). A method of analysis of continuous drawing processes in terms of the basic load-extension-temperature properties of high polymers is given. Experimental work has been largely confined to polyethylene terephthalate, for which material quantitative results are presented. This includes load-extension curves covering the temperature range in which uniform extension takes place and results on "natural" draw ratios when the extension proceeds by necking. A brief account of the theory of "cold-drawing" is given.

POLYAMINOTRIAZOLES AS FIBER-FORMING MATERIALS. J. W. Fisher. J. Appl. Chem. *4*, 212-19 (Apr. 1954). A new series of condensation polymers, the polyaminotriazoles, are described. These are made most simply by condensation of aliphatic dihydrazides in the presence of excess hydrazine. The polymers are fiber-forming and can be melt-spun to give filaments which, after drawing, possess high strength and good affinity for dyestuffs of the acid and disperse types, as used for cellulose acetate rayon.

SYNTHESIS AND PROPERTIES OF A NEW POLYETHER: POLY-3,3-BIS (CHLOROMETHYL)-1-OXABUTENE. A. C. Farthing and R. J. W. Reynolds. J. Polymer Sci. *12*, 503-07 (Jan. 1954). 3,3-Bis(chloromethyl) oxacyclobutane may be polymerized in the presence of powerful electrophilic catalysts, e.g., boron trifluoride; minute traces of water are also necessary for polymerization to proceed. The resulting polyether, poly-3,3-bis(chloromethyl) oxabutene, is an inert, highly crystalline and insoluble polymer, melting point 180° C., capable of forming oriented films and fibers. The high crystallinity and strong interchain forces are reflected by the complete inconsistency of solution viscosity values measured at 100° C. The molecular weights could only be compared by determining melt viscosity values.

Molding and Fabricating

FABRICATION AND USE OF RIGID POLYVINYL CHLORIDE PLASTICS. J. L. Huscher, Materials & Methods *39*, 119-34 (June 1954). Rigid (unplasticized) polyvinyl chloride plastic is a relatively new structural material now available to the engineer and designer. It offers a wide range of excellent properties such as light weight, good corrosion resistance, good electrical properties, and ease of fabrication. Comprehensive information on the physical and chemical properties of polyvinyl chloride, methods for machining and cutting, forming methods, joining methods, and design considerations are presented. The text is accompanied by the generous use of tables and illustrations.

EXTRUSION AND PROPERTIES OF SARAN MONOFILAMENTS. J. Jack and R. A. Horsley. J. Appl. Chem. *4*, 178-88 (Apr. 1954). The manufacturing details of the production of saran (vinylidene chloride copolymer) monofilaments are given. This

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An Alaskan grizzly always comes out of hibernation the first week of May

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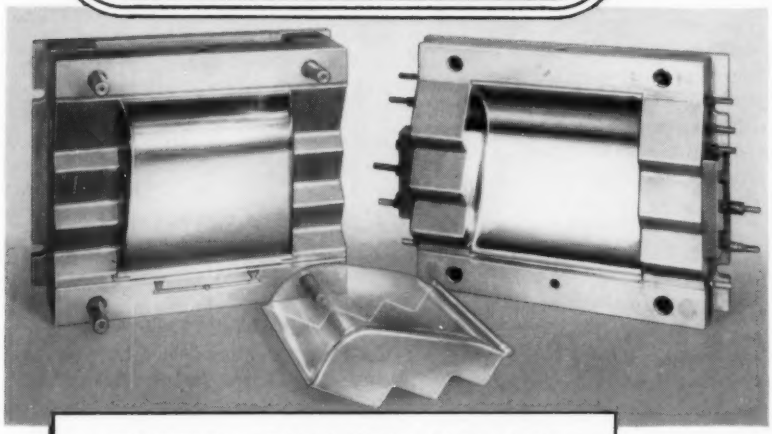

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includes a discussion of the composition of the extrusion compound and of the design of the extruder, metals of construction, heat application, screw design, head and die design, general operation of the extruder, quenching, cold drawing, and the wind-up. The changes in molecular structure occurring during each stage of the production are analyzed, and the effect of these on the properties of the final monofilament are discussed with a view to obtaining the conditions for producing monofilaments with optimum properties.

HIGH-IMPACT POLYSTYRENE SHEET. F. J. McRae and W. D. Harris. SPE J. *10*, 22-25 (May 1954). Methods of fabricating high-impact polystyrene sheet are discussed, with emphasis on vacuum forming, and applications are presented. High-impact polystyrene sheet is particularly suited to vacuum forming because it does not snap back when the forming pressure is removed and it flows easily and offers little resistance to forming at temperatures of 270 to 325° F. Applications include liners and trays for refrigerators, masking frames for TV picture tubes, radio housings, and signs and displays.

WIRE SCREW THREAD INSERTS IMPROVE MOLDED PLASTIC DESIGN. B. Franklin. Materials & Methods *40*, 128-29 (Aug. 1954). The use of coiled wire inserts to provide stronger and more wear resistant screw threads in molded plastics than can be obtained with conventional solid bushings is described. Because of their flexibility, the wire inserts prevent the development of local stresses around the threaded hole in contrast to solid bushings that actually intensify local stresses.

Applications

USE AND POTENTIALITIES OF PLASTICS IN BUILDING. J. B. Singer. Canadian Plastics *1954*, 81-2, 84, 86 (July/Aug. 1954). Present and potential applications of plastics in building are briefly discussed, including the use of synthetic resin adhesives with wood to produce various structural materials, resin-impregnated or resin-bonded materials for walls and partitions, waterproof roof coverings, wall coverings, glazing, plumbing, and flooring.

STRESS CRACKING IN POLYETHYLENE WELDS. F. J. Bockhoff and J. A. Neumann. SPE J. *10*, 17-19 (May 1954). The phenomenon of environmental failure of polyethylene is discussed and the literature on this subject is reviewed. Polyethylene tank liners often fail at welds when exposed to environmental cracking solutions. Results of tests are reported in which three types of weld were exposed to various solutions. In the presence of acetone, Igepal CA-633, or Aerosol OT, the welds failed rather rapidly. In concentrated sulfuric acid, the samples lasted several weeks before failing.

WHY EPOXY RESINS FOR LAMINATED TOOLING? J. Delmonte. Materials & Methods *40*, 93-95 (Aug. 1954). The low shrinkage and good adhesion of epoxy resins are solving many of the problems inherent in production and use of plastic tools in the metal working industries. Factors to be considered in the selection of epoxy resins for laminated tooling are discussed. These include viscosity, ease of wetting, control of run-off on vertical surfaces, pot life and cure, and physical properties.

Coatings

ORGANIC COATINGS ADAPTABLE TO FUEL STORAGE. J. E. Cowling, I. J. Eggert and A. L. Alexander. Ind. Eng. Chem. *46*, 1977-85 (Sept. 1954) Organic coatings suitable for coating concrete and steel tanks used for storing petroleum fuels were developed. Acceptable types are based on the more inert vinyl resins, polysulfide rubbers, and vinylidene chloride-acrylonitrile copolymers. Vinyl coatings properly formulated and plasticized possess the required inertness to resist solvent attack. Their use alone is limited by their lack of extensibility, particularly after aging. This is considered a serious defect when contemplating applications to concrete. The polysulfide rubbers do not possess the high degree of inertness essential for long-term usage with a wide variety of fuels, but they display good adhesion and extensibility—two essential qualities for a fully satisfactory lining. Some polysulfide rubbers can be emulsified with vinyl resin solutions to offer a satisfactory coating material combining the best qualities of both components. The resultant vehicles can be improved further by pigmentation with stabilizing corrosion-inhibitive pigments—notably red lead and litharge. A copolymer of vinylidene chloride-acrylonitrile is among the more fuel-inert materials adaptable as a lining for fuel tanks. It is applicable alone to steel, but in lining concrete it is best utilized as an overcoating for a much more extensible material such as polysulfide rubber. It is adaptable in this role to a very wide range of conditions encountered in repair and maintenance and is particularly valuable as a method of extending the life of linings in old tanks, especially during conversion to storage of the more deleterious fuels, Diesel and jet. A fully satisfactory lining procedure using material in aqueous dispersion is described, thus eliminating solvent hazards. Because the coating can be applied at high solids content, fewer coats are needed. The lining is a combination of a vinylidene chloride-acrylonitrile copolymer with a polysulfide rubber. The stability of the mixed latex is limited though entirely adequate (1 to 2 months), and for this reason it is normally recommended that the materials be blended on the job.

Properties

DETERIORATING INFLUENCES ON DIELECTRIC MATERIALS. L. J. Berberich. Elec. Mfg. *54*, 103-07 (July 1954). Of the deteriorating influences normally encountered, the effects of heat and corona cause the greatest trouble to organic insulating materials. Materials differ widely in their thermal stability behavior. Rubber, for example, is strongly affected by the presence of oxygen, while the rate of deterioration of cellulose is only slightly affected by oxygen. Cellulosic materials deteriorate more rapidly in a sealed container than in open air because the decomposition products accelerate further deterioration. Silicone varnishes have about 100° C. thermal advantage over conventional organic varnishes such as alkyds and phenolics; however, the fluorocarbon resins offer promise of being even more stable thermally than the silicones. Corona discharges have a physical as well as a chemical effect on most organic materials. The physical effect, which appears to be caused by the erosive effect of high velocity ions, is quite pronounced in most varnishes, oils, and resins; even the fluorocarbon resin, Teflon, is attacked almost as readily as its hydrocarbon analog, polyethylene. The chemical effects of corona discharges are important

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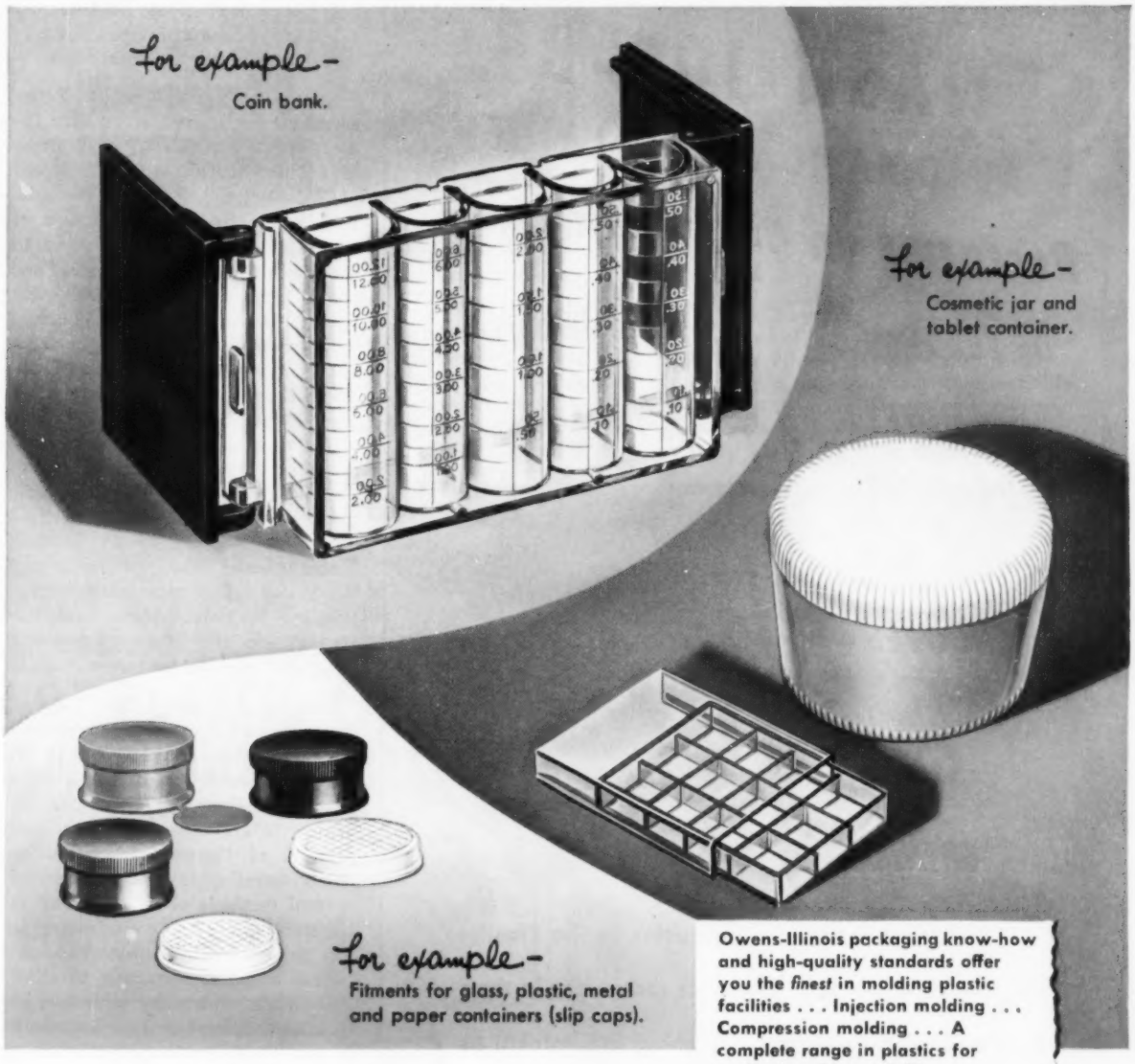

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where air is available to form ozone and the several oxides of nitrogen. Ozone has a powerful oxidizing action on cellulose, varnishes, and other organic materials, while the oxides of nitrogen in the presence of moisture form corrosive acidic products. Apparatus should be designed so as to keep both internal and external discharges to a minimum.

CHANGES IN SOME PHYSICAL PROPERTIES OF POLYETHYLENE BY PILE IRRADIATION AT 80° C. Gt. Brit. Dept. of Atomic Energy. A.E.R.E. Report M/R 1401 (Apr. 2, 1954). By subjecting polyethylene to the effect of ionizing radiation it is possible to produce a whole series of amorphous cross-linked materials which will not melt or dissolve in organic solvents and which vary in type from very flexible to almost glass hard. When the temperature of irradiation is raised, crystallinity disappears at a lower radiation dose, and a more flexible cross-linked material is produced. If these materials are heat treated in a vacuum after irradiation, the initial drop in Young's modulus when heated can be largely eliminated. The percentage crystallinity in polyethylene and the Young's modulus of amorphous unirradiated polyethylene were studied.

FACTORS AFFECTING THE THERMAL STABILITY OF POLYTETRAFLUOROETHYLENE. R. E. Florin, L. A. Wall, D. W. Brown, L. A. Mymo, and J. D. Michaelsen. J. Research NBS 53, 121-30 (Aug. 1954). The structure and kinetics of thermal decomposition of polytetrafluoroethylene suggested several methods of improvement of its stability: a) polymerization in the presence of fluorocarbon catalysts or photochemically to eliminate labile centers for initiation, b) inclusion of foreign structural units in the polymer to promote chain transfer of the free radicals active in depolymerization, c) inclusion of foreign molecules capable of promoting chain transfer. The catalysts tried included perfluorodimethylmercury, perfluoromethyl iodide, and fluorine gas, as well as conventional catalysts. The foreign structural units and additives included sulfur, selenium, and a variety of hydrocarbon and fluorocarbon groups, mainly aromatic, added usually as dibromides to the polymerizing mixture. None of the experimental catalysts or additives

brought about any change in the rate of thermal decomposition.

EFFECT OF SPHERULITES ON PHYSICAL PROPERTIES OF FLUOROTHENE. F. P. Reding and A. Brown. Ind. Eng. Chem. *46*, 1962-67 (Sept. 1954). The structure of spherulites is such that cracks are propagated along the spherulite radii. The spherulites are responsible to a large extent for the lack of clarity, embrittlement, and low voltage breakdown potential of fluorothene. These undesirable properties could be eliminated without sacrificing any of the desirable properties of the resin if the spherulites could be eliminated without substantially reducing the degree of crystallinity. Several methods of reducing the size and perfection of the spherulites are discussed.

DENSITIES OF POLYETHYLENE SOLUTIONS. R. Roberts and F. W. Billmeyer, Jr. J.A.C.S. *76*, 4238-39 (Aug. 20, 1954). A precise method is described for measuring the densities of polyethylene solutions. By appropriate extrapolation of the specific volume-composition curve, an estimate can be obtained of the density of the amorphous regions in polyethylene at temperatures below the crystalline melting point.

REFRACTIVE INDICES OF POLYTHENES WITH DIFFERENT DEGREES OF BRANCHING. M. Baccaredda and G. Schiavinato. J. Polymer Sci. *12*, 155-58 (Jan. 1954). Refractive indices of five polythene samples, previously studied by Bryant and Franta and by Muthana and Mark, who determined their densities, degrees of branching, osmotic molecular weights and μ-values in xylene solutions, were measured by the immersion method in suitable liquid mixtures. Powdered samples were prepared from xylene solutions by cooling and by evaporation of the solvent under identical conditions. They appear, under the miscroscope, as transparent radial and weakly birefringent spherulites; refractive index values are higher than those of the amorphous polythene and decrease as the degree of branching increases. The refractive index lowering is ascribed to the change both in the molecular structure (branching) and in the ratio between the amount of amorphous and of crystalline material, the latter strictly depending on the former when samples are prepared under identical conditions. Measure-

ment of the refractive index may therefore be suitable for the empirical determination of the degree of branching in polythenes; it seems to be simpler and more significant than the measurement of density, the latter also being affected by relatively large microvoids, while the refractive index may be affected only by those microvoids the sizes of which are not larger than the wave length of the light used. Refractive index measurement may also be suitable for the determination of the degree of branching and of the degree of crystallinity in other polymeric substances.

THERMAL PROPERTIES OF POLYESTER RESINS. INFLUENCE OF CROSS-LINKING. T. E. Bockstahler, G. E. Forsyth, J. J. Gouza, F. R. Shirak and E. M. Beavers. Ind. Eng. Chem. *46*, 1639-43 (Aug. 1954). A family of unsaturated polyesters was prepared with regularly varied cross-linking potential (fumarate/succinate ratio). These were copolymerized with various amounts of styrene and the copolymers tested over a range of temperatures for deflection under load and torsional (twisting) modulus. The cross-linking potential of the polyester is shown to have a larger influence on the properties tested than the ratio of polyester to styrene in the copolymer. No unusual effects were observed as the 1:1 ratio of fumarate and styrene units was approached.

Testing

ACIDIC AND ALCOHOLIC COMPONENTS OF POLYESTER. R. W. Stafford and J. F. Shay. Ind. Eng. Chem. *46*, 1625-27 (Aug. 1954). Typical components of unsaturated polyester formulations are itemized, and fractionation methods are discussed. Although some consideration is given to the filler and the cross-linking fractions, attention is concentrated on the polyester. The dicarboxylic acids are identified by the characteristic infra-red spectra of their N-benzylamides. The acids are isolated as the dipotassium salts and mixtures are resolved quantitatively by the application of ultra-violet spectrophotometry. A procedure for the isolation of the dihydric alcohols is described. The polyhydric alcohol fraction is resolved qualitatively by infra-red spectroscopy. The applicability of the various procedures is

demonstrated by a description of the analysis of a commercial formulation.

SHOCK TEST FOR PLASTIC FILMS. J. G. McMillan. Modern Packaging *27*, 119-23, 188 (Aug. 1954). A simple reproducible method was developed for detecting flaws that may cause failure of bags made of polyethylene and other plastic films. The test consists of loading a specified weight of sand into the specified bag and cross sealing at the top. The bag is held by the top, the bottom is lined up with the specified drop distance, and the bag is dropped end on. The drops are repeated until the bag fails. Tests were conducted on plastic bags and the following conclusions drawn: orientation of extruded polyethylene film must be carefully controlled at the point of extrusion to obtain good shock resistance; pressures and temperatures at the time folds are placed in extruded polyethylene tubing must be carefully controlled; some types of treatment to make polyethylene receptive to printing tend to degrade the shock resistance of the film somewhat.

Chemistry

ALLEGED CATALYTIC EFFECT OF HYDROGEN CHLORIDE ON DECOMPOSITION OF PVC AT HIGH TEMPERATURE. E. J. Arlman. J. Polymer Sci. *12*, 543-46 (Jan. 1954). Experiments made with the object of measuring the alleged catalytic effect of hydrogen chloride on polyvinyl chloride decomposition are described. Results indicate absence of this effect.

THERMAL AND OXIDATIVE DECOMPOSITION OF POLYVINYL CHLORIDE. E. J. Arlman. J. Polymer Sci. *12*, 547-58 (Jan. 1954). An investigation into the kinetics and the mechanism of thermal and oxidative decomposition of polyvinyl chloride is reported. The rate of HCl evolution was measured in streams of nitrogen, air, and oxygen. The reaction is described as a chain reaction involving initiation (thermal and oxidative), propagation, and termination (spontaneous and oxidative). A kinetic scheme is given representing the rate of HCl evolution as a function of the reaction constants of the step reactions. The results indicate that thermal decomposition starts at the end groups of the macromolecules, whereas oxygen initiates decomposition within the chain.

U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

POLYMERS. J. S. Rearick (to M. W. Kellogg). U.S. 2,684,959, July 27. Fluorinated copolymers.

MOLDING. F. A. Schultz (to Western Electric). U.S. 2,685,107, Aug. 3. Molding with inserts.

DENTURES. B. N. Greene and T. Wichner (to B. Abrin). U.S. 2,685,-133, Aug. 3. Fitting artificial dentures.

DENTAL TRAY. W. H. Thompson. U.S. 2,685,134, Aug. 3. Glass-fiber reinforced plastic dental impression tray.

PLASTICS. A. Kling (to Badische Anilin). U.S. 2,685,534, Aug. 3. Polyvinyl chloride plastics.

CEMENT. J. L. Perkins and E. E. Sylvester (to B. B. Chemical). U.S. 2,685,572, Aug. 3. Cements for shoe soles.

POLYAMIDES. E. L. Wittbecker and R. C. Houtz (to Du Pont). U.S. 2,685,573, Aug. 3. Polyamides.

POLYMERS. F. K. Signaigo (to U.S.). U.S. 2,685,574, Aug. 3. Polysulfide polymers containing ether groups.

POLYMERIZATION. R. G. Heiligmann and F. Benington (to Borden). U.S. 2,685,575, Aug. 3. Polymerization with boron hydride catalysts.

POLYMERIZATION. W. J. Cerveny, D. E. Burney, and G. H. Weisemann (to Standard Oil). U.S. 2,685,577, Aug. 3. Ethylene polymerization process.

EXTRUSION. W. E. Llewellyn and J. F. Lontz (to Du Pont). U. S. 2,685,707, Aug. 10. Extrusion of polytetrafluoroethylene.

MOLDING. S. W. Pollock (to Aircraft-Marine). U. S. 2,685,708, Aug. 10. Casting device.

AMPOULES. E. E. Lasko (to Sterling Drug). U. S. 2,685,767, Aug. 10. Manufacture of plastic ampoules.

GOLF CLUB. G. G. Oquist (to Plastic Golf Products). U. S. 2,686,056, Aug. 10. Molded plastic golf club head.

CONTAINER. R. D. Cooksley (to Pressure Packaging). U. S. 2,686,-081, Aug. 10. Pressurized plastic container.

MOLDING COMPOSITION. E. E. Sawyer (to Keyes Fibre). U. S. 2,686,-141, Aug. 10. Molding resin-cellulosic pulp compositions.

POLYESTERS. J. A. Arvin and T. Greenfield (to Sherwin-Williams). U. S. 2,686,164, Aug. 10. Polyesters from alkylidene polyaryloxyalcohols.

PLASTICIZER. R. J. Reid, W. M. Smith and B. H. Werner (to Firestone). U. S. 2,868,168, Aug. 10. Glyceryl triester plasticizer for polyvinylidene chloride.

STABILIZERS. C. E. Best (to Firestone). U. S. 2,686,170, Aug. 10. 4-methyl-umbelliferone benzoate stabilizers for polyvinylidene chloride.

RESINS. W. W. Crouch (to Phillips Petroleum). U. S. 2,686,171, Aug. 10. Coagulation of sulfur dioxide resin latices.

INTERPOLYMERS. R. J. Wolf (to B. F. Goodrich). U. S. 2,686,172, Aug. 10. Vinyl chloride interpolymers containing hydroxyl groups.

POLYMERS. J. C. Sauer (to Du Pont). U. S. 2,686,173, Aug. 10. Polymers of unsaturated alkylolamine derivatives.

CASTING. H. D. Anspon and F. E. Pschorr (to General Aniline). U. S. 2,686,174, Aug. 10. Mass polymer casting of alpha-chloroacrylic acid esters.

PLASTICIZERS. L. M. Welch (to Standard Oil). U. S. 2,686,183, Aug. 10. Plasticizing isobutylene-diolefin-divinyl benzene interpolymers.

EXTRUSION. F. R. Gross. U. S. 2,686,335, Aug. 17. Plastic extrusion.

SEALING. E. Gerber and S. Zaretsky. U. S. 2,686,556, Aug. 17. Machine for sealing thermoplastic materials.

PRINTING. J. M. Kuhn (to Sherwin-Williams). U. S. 2,686,736, Aug. 17. Color printing resin films.

COATING. R. F. Caroselli and R. K. Gagnon (to Owens-Corning). U. S. 2,686,737, Aug. 17. Coating glass fabric with butadiene-acrylonitrile.

DISPERSION. W. O. Teeters (to M. W. Kellogg). U. S. 2,686,738, Aug. 17. Dispersion of trifluorochloroethylene.

INSULATION. J. T. Goodwin (to Dow Corning). U. S. 2,686,740, Aug. 17. Conductor insulated with polyester resin.

WRAPPING. R. T. K. Cornwell (to American Viscose). U. S. 2,686,744, Aug. 17. Regenerated cellulose-melamine wrapping.

BELTING. D. E. DeMatteo (to Thielex Plastics). U. S. 2,686,745, Aug. 17. Woven plastic belting.

SEALING. J. W. Wurtz and F. A. Greenwald (to National Motor Bearing). U. S. 2,686,747, Aug. 17. Polysiloxane sealing material.

SPLICING. D. L. Wolfe and E. A. Ruddy (to Institute of Paper Chemistry). U. S. 2,686,748, Aug. 17. Splicing paper with polyvinyl acetate.

LEATHER FINISH. C. H. Geister and J. M. Collins (to Du Pont). U. S. 2,686,764, Aug. 17. Caprolactam resin polymer composition.

VARNISHES. J. A. Arvin (to Sherwin-Williams). U. S. 2,686,765, Aug. 17. Varnishes containing hemiquinoid compounds.

DISPERSION. I. Green (to M. W. Kellogg). U. S. 2,686,767, Aug. 17. Aqueous dispersions of fluorochlorinated polymers.

FLAMEPROOFING. J. G. Frick, Jr. and J. W. Weaver (to United States). U. S. 2,686,768-9, Aug. 17. Polymeric flameproofing compositions.

DISPERSION. C. D. Dipner (to M. W. Kellogg). U. S. 2,686,770, Aug. 17. Dispersion of fluorocarbon polymers.

RESINS. L. N. Whitehill and R. S. Taylor (to Sherwin-Williams). U. S.

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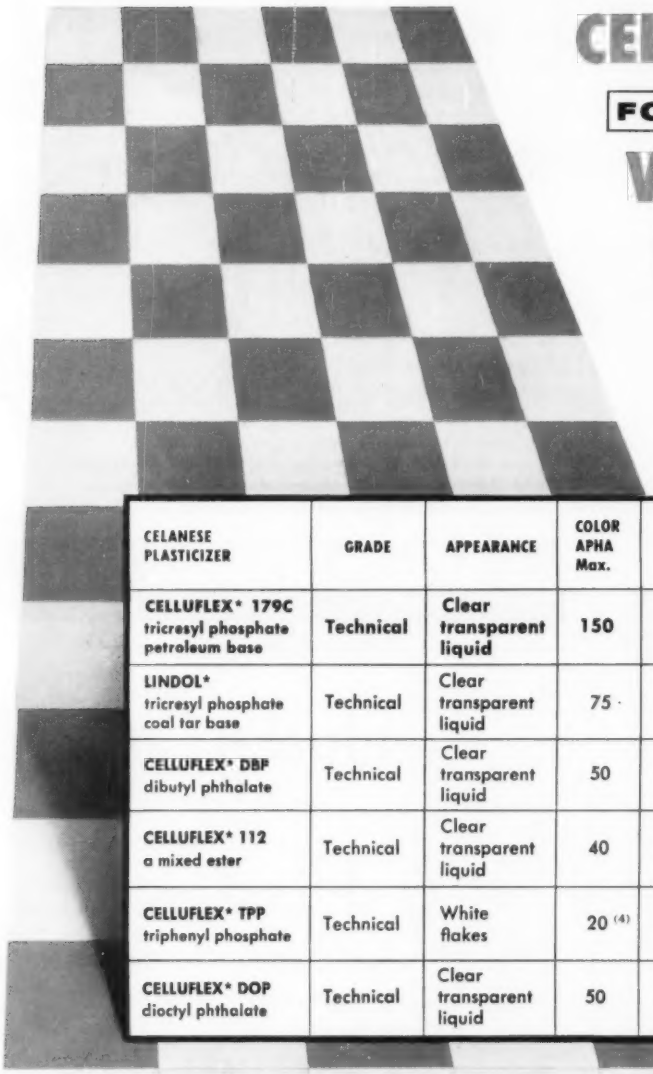

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CELLUFLEX* 179C tricresyl phosphate petroleum base	**Technical**	**Clear transparent liquid**	**150**	**1.165 ± .005**	**0.01 (3)**	**99**	**30**	**1.553 (5)**
LINDOL* tricresyl phosphate coal tar base	Technical	Clear transparent liquid	75	1.165 ± .005	0.01 (3)	99	30	1.556
CELLUFLEX* DBP dibutyl phthalate	Technical	Clear transparent liquid	50	1.045 ± .001	0.01 (2)	98	—	1.4889
CELLUFLEX* 112 a mixed ester	Technical	Clear transparent liquid	40	1.210 ± .005	0.01 (3)	99	30	1.560 (5)
CELLUFLEX* TPP triphenyl phosphate	Technical	White flakes	20 (4)	1.221 (1)	0.003 (3)	99	30	1.550 (6)
CELLUFLEX* DOP dioctyl phthalate	Technical	Clear transparent liquid	50	0.985 ± .002	0.01 (2)	98	—	1.4859

(1) @ 60/60° C. (2) % as phthalic, max. (3) % as phosphoric, max. (4) Molten (5) @ $n\frac{25°\ C.}{D}$ (6) @ $n\frac{60°\ C.}{D}$

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Celanese® CHEMICALS

2,686,771, Aug. 17. Acid-modified ether resins.

POLYMERS. G. F. D'Alelio (to Koppers). U. S. 2,686,773-4, Aug. 17. Polymers of the N-pyridyl imides of maleic and citraconic acids.

POLYMERIZATION. E. G. Howard, Jr. (to Du Pont). U. S. 2,686,775, Aug. 17. Hydrazide-oxidant-copper salt polymerization initiator.

FILM. K. L. Knox (to Du Pont). U. S. 2,686,931, Aug. 24. Apparatus for extruding beaded film.

BINDERS. M. J. Zaleski (to General Binding). U. S. 2,686,932, Aug. 24. Apparatus for making plastic binders.

MOLDING. H. B. Wood (to Imperial Chemical). U. S. 2,686,933, Aug. 24. Molding apparatus.

MOLDING. M. D'Amore. U. S. 2,686,934, Aug. 24. Injection molding apparatus.

MOLDING. L. L. Stott (to Polymer). U. S. 2,686,935, Aug. 24. Molding nylon.

LINING. A. J. Tuckerman, M. Kushner and A. Gallaccio. U. S. 2,686,936, Aug. 24. Molded plastic lining for perforated cartridge cases.

CONTAINER. C. J. Cowan (to Cowan Boyden). U. S. 2,687,157, Aug. 24. Plastic container.

ION EXCHANGE. G. B. Butler and R. L. Bunch (to State of Florida). U. S. 2,687,382, Aug. 24. Quaternary ammonium ion exchange resins.

ION EXCHANGE. G. F. D'Alelio (to Koppers). U. S. 2,687,383, Aug. 24. Ion exchange resins from difunctional phenols and polyfunctional unsaturated compounds.

WIRE COATING. E. H. Olson (to Anaconda Wire and Cable). U. S. 2,687,385-6-7, Aug. 24. Wire coatings.

RESIN. H. W. McNulty and D. J. Killian (to National Distillers). U. S. 2,687,388, Aug. 24. Phenylmethyl siloxane solution containing zirconium salt.

PLASTICIZERS. J. Dazzi, W. S. Emerson and R. A. Heimsch (to Monsanto). U. S. 2,687,389-90-1-2, Aug. 24. Plasticizers for polyvinyl chloride.

COATED PARTICLES. H. J. Somermeyer (to Diamond Alkali). U. S. 2,687,394, Aug. 24. Particles of cal-

cium carbonate coated with polyvinyl chloride.

POLYMER. B. M. Marks (to Du Pont). U. S. 2,687,395, Aug. 24. Polymethyl methacrylate of improved electrical conductivity.

RESIN. W. M. McLean (to Dow Corning). U. S. 2,687,396, Aug. 24. Composition of silicone-alkyd, epoxy and phenolic resins.

RESINS. H. Dannenberg (to Shell). U. S. 2,687,397, Aug. 24. Resin forming compositions including amine salts of sulfonic acids.

RESIN. W. M. McLean (to Dow Corning). U. S. 2,687,398, Aug. 24. Composition of Silicone-alkyd and epoxy resins.

POLYMERS. G. F. D'Alelio (to Koppers). U. S. 2,687,400-1, Aug. 24. Polymers of N-pyridyl itaconic amide.

POLYMERS. G. L. Wesp and R. R. Morner (to Monsanto). U. S. 2,687,-402, Aug. 24. Vulcanized polycyanoalkoxy alkyl acrylates.

POLYMERS. S. A. Ballard, R. C. Morris and V. W. Buls (to Shell). U. S. 2,687,403, Aug. 24. Polymers of unsaturated N-substituted amides of substituted aromatic acids.

COPOLYMERS. J. A. Robertson (to Du Pont). U. S. 2,687,404, Aug. 24. Epoxy-containing copolymers of 4-vinylcyclohexene monoepoxide and an unsaturated compound.

COPOLYMERS. H. S. Rothrock and W. K. Wilkinson (to Du Pont). U. S. 2,687,405, Aug. 24. Allylglycidyl-ether-acrylate ester copolymers.

POLYMERS. R. E. Foster (to Du Pont). U. S. 2,687,406, Aug. 24. 4-Vinylcyclohexene monoepoxide polymers.

RESINS. H. Orth (to Dynamit). U. S. 2,687,407, Aug. 24. Resins from diallylidene pentaerythritol and a polyhydroxy alcohol.

POLYMERIZATION. J. M. Grim (to Koppers). U. S. 2,687,408, Aug. 24. Aqueous polymerization.

POLYMERIZATION. G. C. Claver, Jr. (to Monsanto). U. S. 2,687,442, Aug. 24. Polymerization inhibitors.

SEPARATOR. E. W. Merrill (to Dewey and Almy). U. S. 2,687,445-6-7, Aug. 24. Resin-impregnated felt battery separators.

BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Packaging Engineering," by Louis C. Barail

Published in 1954 by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 406 pages. Price: $9.50.

The complete range of packaging materials and techniques is investigated in this volume. Included are discussions of types of containers, machinery, package design, protection against deterioration, testing, printing inks, etc. Three chapters deal with packaging problems in the food, drug, and cosmetic industries; and much space is devoted to plastics and adhesives. Of special interest are chapters on packaging for export and packaging for the Armed Forces.

"The Technology of Solvents and Plasticizers," by Arthur Doolittle

Published in 1954 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 1056 pages. Price: $18.50.

"The Handbook of Solvents," by Leopold Schefland and Morris Jacobs

Published in 1954 by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y. 704 pages. Price: $10.00.

Plasticizer and solvent literature has been greatly enriched with the publication of these two volumes.

Arthur Doolittle, assistant director of research at Carbide and Carbon, has written a comprehensive survey of the theoretical and practical aspects of all commercially available solvents and plasticizers. His emphasis is on the behavior of solvent systems rather than on specific formulations. His discussion of technological fundamentals is illustrated by charts showing how various properties are affected by variations in components and conditions, giving the reader a basis for arriving at his own answers to specific formulating problems. Complete physical and chemical data on 161 solvents and 131 plasticizers commercially available are included.

Messrs. Scheflan and Jacobs, in their work, have stressed the compilation of the physical properties and other specification data of over 2700 liquid organic compounds; the bulk of the book is devoted to this information. For each compound the following constants are listed: synonyms, chemical formula, characteristics, formula weight, boiling point, specific gravities, refractive index, surface tension, flammability, flash point, specific heat, uses, solubility, and other data. The volume also contains chapters of a more generalized nature, such as sections on safe practices in the use of solvents, solvent action and power, vapor pressure, dilution ratios, limits of flammability, and solvent recovery. An index of synonyms is included.

"Symposium on Temperature Stability of Electrical Insulating Materials"

Published in 1954 by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 141 pages. Price: $2.75.

In view of the rapid development of new insulating materials in recent years, the need for test methods and standards that could serve as guides for determining the thermal stability of insulating materials has become increasingly apparent. This symposium, sponsored by A.S.T.M. Committee D-9 on Electrical Insulating Materials, and presented at the 57th Annual Meeting of the Society, constitutes an important contribution to the filling of this need.

"Cellulose and Cellulose Derivatives, Part I, 2nd ed.," edited by Emil Ott, Harold M. Spurlin, and Mildred W. Grafflin

Published in 1954 by Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. 510 pages. Price: $12.00.

This second edition of a work originally published in 1943 aims to present an up-to-date picture of the most important scientific and technical information concerning cellulose and its derivatives and to summarize current thinking in the field. Scientific aspects are treated in full, and technological details and processing information are included. Part I covers the following topics: occurrence of cellulose, chemical nature of cellulose and its derivatives, structure and properties of cellulose fibers, and properties of substances associated with cellulose in nature. Part II will cover preparation of cellulose from its natural sources, bleaching and purification of wood cellulose, properties and treatment of pulp for paper, and derivatives of cellulose. Part III will treat of physical properties of cellulose and its derivatives in solution, mechanical properties of cellulose and its derivatives, and tests for cellulose and its derivatives. Part III will also contain the complete appendices and author and subject indices.

"The Classification of Fire Hazards and Extinction Methods," by James D. Birchall

Published in 1954 by Ernest Benn Ltd., London, England, and distributed in the United States by John de Graff, Inc., 64 W. 23rd St., New York 10, N. Y. 97 pages. Price: $1.50.

A highly concise and systematic summary of data on fire extinction, prevention, and related topics, this little book is of particular value to those responsible for the handling of chemicals and plastics. In three sections it presents information on general hazards and metals; hazards involving plastics; and gases, dust, and chemicals subjected to spontaneous combustion.

Management techniques—"Practical Techniques for Forecasting, Planning, and Control," Number 216 in the A.M.A. Manufacturing Series, presents an analysis of sales forecasting, production planning, and production control as practiced by two companies (Eli Lilly & Co. and Bell & Howell Co.). Charts involved in these techniques are included. A panel discussion on the techniques used by each of the two companies is also presented. $1.50 ($1.00 to members of A.M.A.). *American Management Association, 330 W. 42nd St., New York 36, N. Y.*

Products and facilities—This four-page catalog describes facilities for the fabrication of fluorocarbon products (Teflon, Kel-F, and Fluorothene), and pictures a range of standard and custom-made parts produced from these resins, including spiral back-up rings, O-rings,

New plastic exposure meter carrying case clicks with photographers

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Continental is an old hand at applying plastics to product problems. Like artists, our designers work with a full palette of colors, types and properties. Have you ever thought of your product in plastic? Why not? Talk it over with Continental.

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...Pace-Makers in Plastics Molding

V-seal packings, piston seals, and others. *W. S. Shamban & Co., 11617 W. Jefferson Blvd., Culver City, Calif.*

Conveyors—Bulletin TV-553 describes a pneumatic conveying system for use in car loading and unloading, with in-process operations, and for transporting hygroscopic, hazardous, and toxic materials. Pilot plant experimental facilities for testing the system are available. *Young Machinery Co., Muncy, Pa.*

Marketing research—The problems of market research as they apply to the chemical industry are investigated in this 65-page publication. The booklet outlines in detail the various approaches and methods utilized to find product users, and goes into a discussion of the various sources of chemical marketing research data. An economic and historical survey of the chemical industry is included. $1.00. *Chemonomics, Inc., 270 Park Ave., New York 17, N. Y.*

Plastisols—Property and application information on a line of vinyl plastisol-based protective coatings is presented in this four-page folder. Representative suggested uses are included. *Arbonite Corp., 900 N. Main St., Doylestown, Pa.*

Machine tool accessories—Catalog 5418 lists specifications on a complete line of machine tool attachments and accessories for engine lathes (9 through 16-24-in. swings), turret lathes, drill presses, 7-in. bench shaper, and 8- or 10-in. pedestal grinder. Price information is included for each listing. *South Bend Lathe Works, 425 E. Madison St., South Bend 22, Indiana.*

Plasticizer—Properties and performance of diisodecyl adipate, a low-volatility, low-temperature plasticizer for polyvinyl chloride resins, are described in Technical Bulletin O-113. The product is similar to di-2-ethylhexyl adipate (D.O.A.) in properties imparted to vinyl formulations, but is only one-third as volatile. *Monsanto Chemical Co., Organic Chemicals Div., St. Louis 1, Mo.*

Color control—Bulletin FS-246 describes a multi-stimulus colorimeter with the aid of which exact color duplication and color matching is claimed to be possible. The unit establishes a simple numerical formula for each sample analyzed. The color represented by such a formula can be reproduced at any time by resetting the instrument dials to the same values for each primary as were in the original sample. The unit also finds application in measuring color differences and testing color blindness. Its use does not require any lengthy calculations. *Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.*

Vacuum forming—Various phases of the vacuum forming process, especially as it applies to forming of metallized sheeting, are covered in this technical bulletin. Subjects discussed include: applications, materials, colors, equipment, heaters, molds, timing, and printing. Names and addresses of several suppliers of vacuum forming machines and silk screen inks are included. *Gomar Mfg. Co., Inc., 79 Paris St., Newark 5, N. J.*

Transmission belt—Design characteristics of a single, endless belt with molded lengthwise ribs, are presented in Brochure 6638. The belt, designated Poly-V, is a single unit across the full width of a sheave, rather than an assembly of several V-belts. This construction is claimed to increase contact area, increase horsepower delivery, eliminate matching, reduce face pressure, allow shorter center, and afford other advantages. *Raybestos-Manhattan, Inc., Manhattan Rubber Div., Passaic, N. J.*

Injection machine—Bulletin 560 describes a fully automatic 4-oz. injection machine said to give positive ejection of degated, finished pieces. Six close-up photos of the ejection phase of molding cycle show in detail how complete degating is automatically accomplished. The bulletin describes construction of the machine and lists specifications. *F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa.*

Pressure recorders—Bulletin 6-10 catalogs a complete line of pressure-measuring elements designed for direct measurement, remote transmission, and automatic control. The operation of each instrument is explained. The bulletin also lists charts for standard process ranges and covers accessories. *The Foxboro Co., Foxboro, Mass.*

Plastics research—This 156-page survey of research problems in plastics, with special reference to the development of the plastics industry in India, was compiled under the auspices of the Plastics Research Committee of the Council of Scientific and Industrial Research of India. The subjects covered by the survey include: fundamental research in plastics, natural resins, naturally occurring polymers, polycondensation products, processing of plastics, raw materials, specifications and testing, and others. As applicable, the state of knowledge for any particular field is summarized and various research problems in that field stated. A chapter on the status of the plastics industry is included. Price Rs 5 (ca. $1.05). *Council of Scientific and Industrial Research, Old Mill Road, New Delhi 2, India.*

Drill heads—This illustrated brochure depicts a line of custom-made multiple-spindle drill heads for use on plastics and metals. *B. M. Root Co., York, Pa.*

Chemicals—This product catalog lists a large variety of inorganic and organic chemicals for use by industry and agriculture, including boron, sodium, potassium, lithium, and bromine compounds; insecticides, miticides, fumigants, defoliants, and weed killers; and refrigerants. Properties and applications of each chemical listed are presented. *American Potash & Chemical Corp., 3030 W. 6th St., Los Angeles 54, Calif.*

Plastics welding—Details on the construction and design of a high-frequency generator that permits conversion between two input power ratings of 2000 and 4000 d.-c. watts are presented on Leaflet G-554. Application notes, specifications, line power requirements, weight, and dimensions are given. *Electronic Processes Corp., 1170 San Antonio Rd., Los Altos, Calif.*

Cylinders—A line of air and hydraulic cylinders is presented in this 12-page pamphlet, together with their design and construction details. Also

included are four tables showing the mounting dimension of this line of cylinders along with dimensions of cylinders of other manufacture which wholly or partially conform. The cylinders presented are claimed to have features making them particularly applicable to automatic operations. These features include: standardization of critical cylinder mounting dimensions, interchangeable mountings, standardized stroke lengths, and others. *Miller Fluid Power Co., 2040 N. Hawthorne, Melrose Park, Ill.*

Short-run molding—Facilities and materials for injection and compression custom-molding in small-run lots are presented in this eight-page brochure. Typical costs per run are given. *Dayton Rogers Mfg. Co., 2824 13th Ave., S., Minneapolis 7, Minn.*

Cutters—This four-page folder describes a line of cutters for use in various phases of the plastics and other industries. Included are machines for cutting fibrous glass to staple lengths, flock cutters, bale breakers, trim cutters, and others. *Taylor-Stiles & Co., Riegelsville, N. J.*

Plastics industry—The sixth edition of "Plastics, the Story of an Industry" presents an up-to-date picture of the status of the plastics industry in the United States. It deals with the industry's history, development, branches, manufacturing processes, types of plastics used, and the varieties of products made from them. Employment opportunities, educational facilities, and trade publications are covered. A comprehensive bibliography is included. Space for imprinting company name is provided on back cover. Quantity prices are as follows: 10 to 50 copies—30¢ per copy; 51 to 500 copies—28¢ per copy; 501 to 1000 copies—26¢ per copy; over 1000 copies—25¢ per copy. *The Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36, N. Y.*

Safety control—Equipment needed for rescue operations and safety control is outlined in a 16-page booklet entitled "Disaster! Are You Prepared for It?" Separated into five sections, the booklet discusses the equipment needs for a rescue team, an engineering team, and a medical team. It also contains a table-of-equipment check-chart, and has a catalog description and picture for each item recommended. *Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.*

Products and facilities—Vulcanized fibre, thin fish paper insulation, laminated thermosetting plastics, motor insulation, fibre board, transformer board, and materials handling equipment are the products described in this 40-page catalog. Applications, classified by industries, are presented; available grades and specifications are listed. Products described are offered in the form of sheets, rods, tubes, coils, fabricated parts, etc. *Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y.*

Nitroparaffins—Four nitroparaffins and six derivatives are described in this data sheet. Industrial applications and properties are indicated. The chemicals are used for solvents, raw materials of synthesis, emulsifiers, reducing agents, and other applications. *Commercial Solvents Corp., 260 Madison Ave., New York 16, N. Y.*

Vinyl butyral—Technical Release No. 11 presents data on general properties, solubility, compatibility, and compounding of vinyl butyral resins. The material, well known for the part it plays in the manufacture of safety glass, also finds application in adhesives, wood finishes, cloth coatings, metal finishes, and, most important, as metal conditioners (wash primers). Suggested formulations are given. *Bakelite Co., a Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.*

Valves—Bulletin 1010 catalogs a complete line of standard four-way hand-, foot-, power-, and solenoid-operated valves. Dimensions and weights, application diagrams, circuit diagrams, and parts and accessories lists are also included. *Ledeen Mfg. Co., 1600 S. San Pedro St., Los Angeles 15, Calif.*

Product catalog—All the products commercially available from the Synthetics Dept. of this company are listed in an 8-page catalog. They include over 30 synthetic resins, several plasticizers, a number of non-ionic surface-reactive agents, and pentaerythritol. Property data and descriptive information are listed for each compound. *Hercules Powder Co., Inc., Wilmington, Del.*

Organic chemicals—Specifications and property data for approximately 50 organic solvents and chemicals are listed in this 76-page brochure. Covered are alcohols, ketones, esters, glycol ethers, lacquer solvents, plasticizers, chlorinated solvents, glycols, amines, aromatic solvents, aliphatic naphthas, and denatured alcohol formulas. A table for gaging contents of not completely filled 55-gal. drums at various temperatures and liquid levels and a temperature conversion chart will be found helpful. *Chemical Solvents, Inc., 60 Park Pl., Newark 2, N. J.*

Process equipment—Bulletin 13 catalogs a line of blending, processing, and heat exchange equipment for the chemical and processing industries. Included are transparent-shell blenders, in laboratory and production models; twin-shell dry blenders; pilot plant equipment; saponification kettles, impregnating units; autoclaves; reactors; and others. *The Patterson-Kelley Co., Inc., East Stroudsburg, Pa.*

Granulating equipment—Advantages that a company can derive from granulating its own plastics scrap are outlined in this bulletin. Also included is a specification chart listing capacities, screen openings, dimensions, horsepower, etc., for a line of granulating machines. *American Pulverizer Co., 1249 Macklind Ave., St. Louis 10, Mo.*

Ejector pins—Dimensions and prices for a line of ejector pins are listed in this 8-page brochure. The following types are covered: Hotform, Nitralloy, threaded, core, return, sprue puller, and stop pins. *Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit 12, Mich.*

Acetate solvent—Four-page technical bulletin F-8623 gives data on physical properties, specifications, shipping data, general solvent properties, constant boiling mixtures, physiological properties, and suggested uses for methyl Cellosolve acetate. The material is used as a solvent for cellulose acetate and

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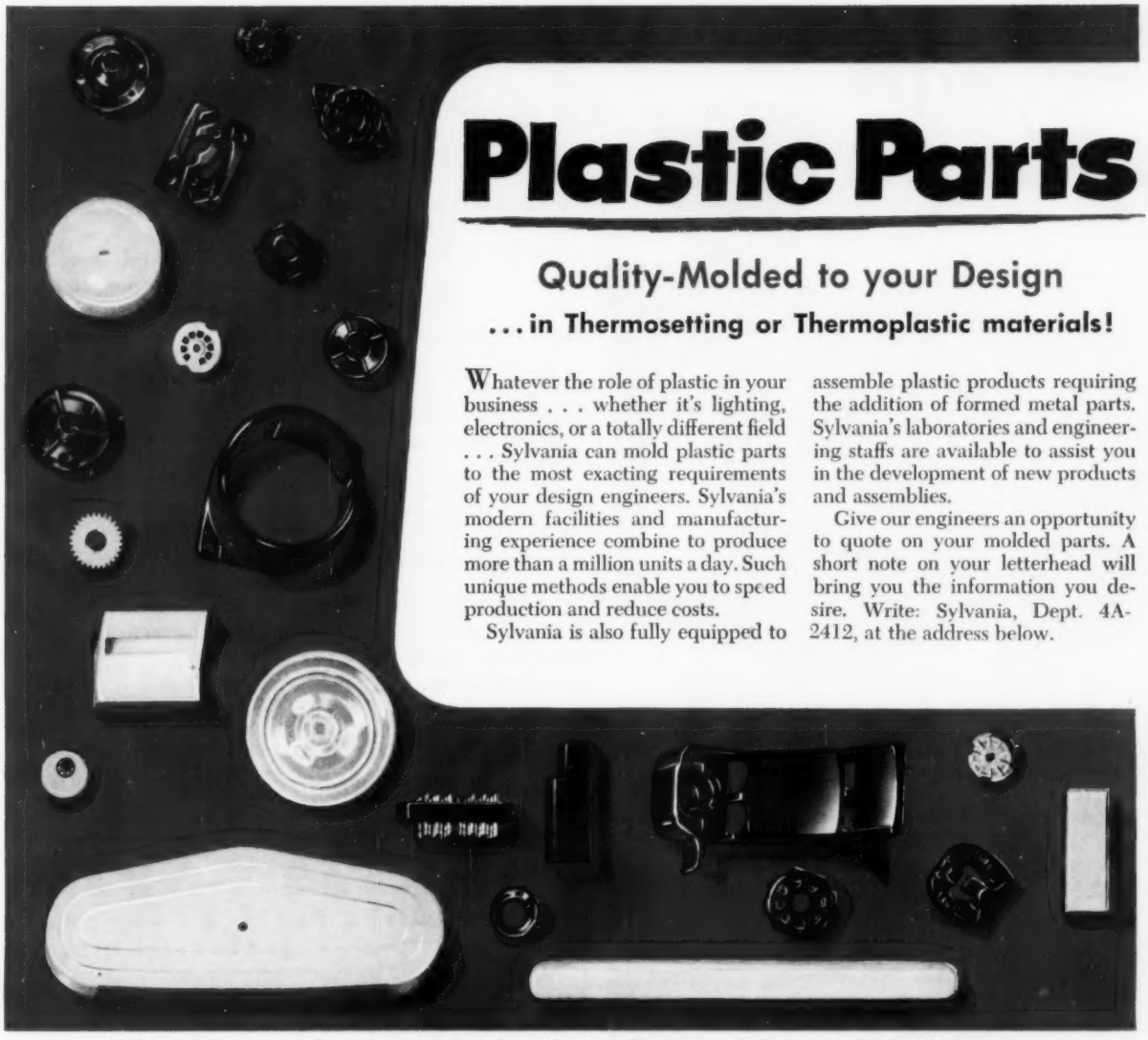
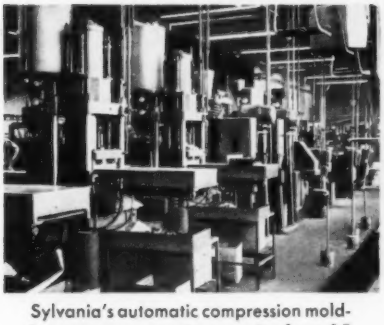
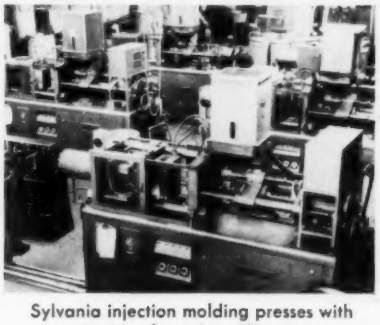
Give our engineers an opportunity to quote on your molded parts. A short note on your letterhead will bring you the information you desire. Write: Sylvania, Dept. 4A-2412, at the address below.



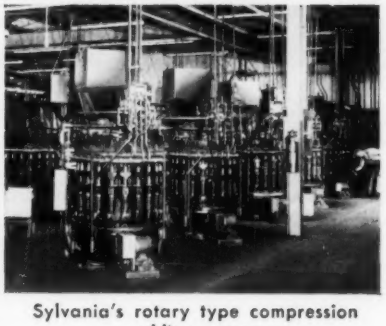
A few of the many plastic parts Sylvania molds for electronics, lighting, and other industries



Sylvania's automatic compression molding presses range in capacity from 15 to 150 tons.



Sylvania injection molding presses with capacities from 4 to 48 ounces.



Sylvania's rotary type compression molding presses.

In Canada:
Sylvania Electric (Canada) Ltd.
University Tower Bldg.
St. Catherine St., Montreal, P. Q.

SYLVANIA

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

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other cellulose esters, as well as in the formulation of lacquers and dopes. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Pacific directory—This 10-page industrial directory lists 141 firms engaged in various phases of the plastics industry which are operating in the San Francisco Bay Region. Both a classified and an alphabetical listing are provided. The classified section lists molding; fabricating; film and sheet processing; laminating; extruding; vacuum forming; impregnated cloth; fibrous glass products; woven plastic rope and cable; cabinet, sink, and table top laminating and fabricating; machinery and equipment; materials suppliers; and services. *San Francisco Chamber of Commerce, Inc., 333 Pine St., San Francisco 4, Calif.*

Extender—Technical Bulletin 1 describes Halowax Product 4004, a chlorinated paraffin extender for use in plasticizing systems for vinyl resins. The product is said to have much lower viscosity than comparable compounds. The bulletin includes significant property data, and typical formulations for compounds for injection molding, continuous flooring, sheeting, and extruded wire insulation. *Bakelite Co., a Div. of Union Carbide and Carbon Corp., 300 Madison Ave., New York 17, N. Y.*

Reinforced plastics—Facilities for mold making, research and product development, and custom molding of fibrous glass-reinforced plastics products are outlined in this four-page folder. Typical applications are listed. *Clearfield Plastics, Inc., P. O. Box 510, Clearfield, Pa.*

Thermoset laminates—An up-to-date tabulation of Military, Army, Navy, JAN, Federal, Bur. Aero., AAF, and A.S.T.M. specifications for 24 grades of thermosetting laminated plastics is presented in this chart. *Synthane Corp., Oaks, Pa.*

Instrumentation—Proper application of instrumentation to various product techniques are described in several articles in the 1954 third quarter issue of *Instrumentation*. These articles deal with topics such as production techniques in the manufacture of plastic key tips, dairy

products, and electrical insulators; utilization of a variety of industrial instruments to speed up high-temperature alloy tests at the Naval Research Laboratory; round-the-clock production techniques in the processing of gamma globulin serum; and others. *Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 22, Pa.*

File folder—A permanent reference folder, made of heavy coated paper, is designed to accommodate published information on phenolic resins for convenient consultation. Of standard manila folder size, a pocket in the folder holds manuals, catalog sheets, and other product information. *The Marblette Corp., 37-21 30th St., Long Island City 1, N. Y.*

Printing equipment—Catalog sheets on a line of marking machines cover the following: Model 19A, for marking flat plastics, wooden, and painted articles; Model 20A, for marking cylindrical objects: Model 25A, for package, label, and product marking; Model 25AD, a semi-universal dial feed machine; Model 26A, a pressure-sensitive tape printer; Model 45A, a flat surface printer for marking or imprinting boxes, bags, envelops, flat plastics items, etc.; Model 45AE, semi-automatic flat object printer; Model 52AC, cylindrical object marker; Model 67A, a two-color curved-surface printer; and Model 126, for producing fabric or paper labels from rolls of blank material. *Markem Machine Co., Keene, New Hampshire.*

Plasticizers—Physical and performance properties of a line of plasticizers are presented in graph-form in this 16-page booklet. A table of plasticizer recommendations is also included. *Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.*

Furan resins—Two application bulletins describe uses of furan resins in the chemical industry. Bulletin F-54-5 deals with resin X-2 which, in combination with activated silica, forms a mixture that hardens into a heat-resistant, chemically inert surface; the resin is recommended for troweling floors in chemical plants. Bulletin F-54-4a describes the use of Jet-Kote X-3M, a furan coating that may be applied to the surfaces

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A PIONEER IN PLASTICS FOR OVER THIRTY YEARS

of concrete storage tanks, rendering them suitable for handling of chemicals. *Furane Plastics, Inc., 4516 Brazil St., Los Angeles 39, Calif.*

Vacuum metallizing—Catalog 780 lists specifications for a complete line of vacuum metallizing equipment, including units with 24-, 48-, and 60-in. vacuum chambers. In addition, the catalog describes in detail the process of vacuum metallizing and its applications, including the following topics: uses of vacuum metallizing; properties of vacuum metallized coatings; basic advantages of vacuum metallizing; modern development in vacuum metallizing; and a step-by-step description of a vacuum metallizing operation. *F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa.*

Ethylene glycol—Technical Information Bulletin F-8327 presents physical properties, specifications, shipping data, constant boiling mixtures, physiological properties, and uses of ethylene glycol. This hygroscopic material is used as a base for antifreezes and coolants; as an ingredient in hydraulic fluids; as an intermediate for explosives, resins, and plasticizers; and as a solvent and humectant. *Carbide and Carbon Chemical Co., 30 W. 42nd St., New York 17, N. Y.*

Methacrylic acid—Properties and specification data of glacial methacrylic acid are published in this 16-page brochure. Other information presented includes data on copolymerization, reactions, applications, handling, shipping, etc. Among the applications are adhesives and bonding agents, laminating resins, coating compositions, polymer dispersions, films, ion exchange resins, rubber applications, and others. *Rohm & Haas Co., Special Products Dept., Washington Sq., Philadelphia 5, Pa.*

Industrial counters—Descriptions of equipment and techniques for controlling industrial equipment by means of preset electronic counters are given in this 20-page booklet. The instruments described include counters that can be preset to apply control after any desired number of counts from 1 to 1 million and a line of count detectors for converting physical increments into electrical impulses for counting. *Potter Instrument Co., Inc., 115 Cutter Mill Rd., Great Neck, N. Y.*

Acrylonitrile toxicology—Abstracts of the more important experimental data relating to the toxicology of acrylonitrile are published in this 16-page booklet. Also included is a section on the treatment of persons who have been exposed to the chemical. *American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.*

Bushings—How to make sheet metal and plastics laminated drill templates, using Anchor Bushings, is outlined in step-by-step fashion in this revised catalog. An up-to-date line of Anchor Bushings is also presented. *The Hi-Shear Rivet Tool Co., 8924 Bellanca Ave., Los Angeles 45, Calif.*

Materials handling—Uses of wooden pallets for moving materials or products from one place to another are described in this handbook, entitled "Pallets and Palletizing." Included are sections on the principles of pallet construction, choosing the

correct pallet, pallet specifications, how to purchase pallets, and using and maintaining pallets. *National Wooden Pallet Manufacturing Association, Barr Bldg., Washington 6, D. C.*

Water-soluble resinates—Uses of a series of sodium and potassium salts of various processed rosins and tall oils as emulsifiers, detergents, and dispersants in soluble oils and cleaning powders is described in this technical bulletin. The material, tradenamed Dresinate, is available in liquid, dry, and paste form. The bulletin contains three tables listing the characteristic properties of Dresinate in all three states. Other tables include typical formulations. *Hercules Powder Co., Inc., Wilmington, Del.*

Rubber abrasion—This bibliography of published works on abrasion testing of natural and synthetic rubbers contains approximately 150 references, based on various sources. A digest of each article is given with each reference. *American Chemical Society, Rubber Division Library, University of Akron, Akron 4, Ohio.*

Adhesives—This useful booklet, Manual 110, lists in chart form a line of adhesives for film, foil, fabrics, and other web laminations. Specific adhesive formulations are tabulated against a list of laminating materials, including various plastics, metals, rubber, paper, wood, cork, etc., classified into "recommended for exceptional bond strength," "general production use," and "not tested or not recommended." A check list of "end-use" properties of the completed laminations, a classification of adhesives by properties, and a general summary of requirements for efficient laminating are also included. *Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N. J.*

Instrumentation—Published several times per year, *Apparatus Digest* describes a range of instruments, apparatus, and other laboratory equipment for use in testing, research, and control. The current issue includes data on vernier-action needle valves, flexible wrap-around heating tapes, humidity-indicating cards, portable refrigeration systems, pumps, and others. *A. Daigger & Co., 159 W. Kinzie St., Chicago 10, Ill.*

NEW MACHINERY AND EQUIPMENT

Welding Equipment—The Ectromag Magnetic-Bar Electrode, which is said to incorporate all the functions of a conventional electronic-sealing press into the electrode itself, finds particular application in welding large areas of plastics sheeting.

The unit has a box-like steel magnetic structure which completely encloses the r.-f. electrodes. Magnetic coils mounted below draw a free keeper bar downward when energized to apply welding pressure for the plastic sheeting against the electrode. Pressure is adjusted by regulating the voltage through the magnetic-actuating coil circuit.

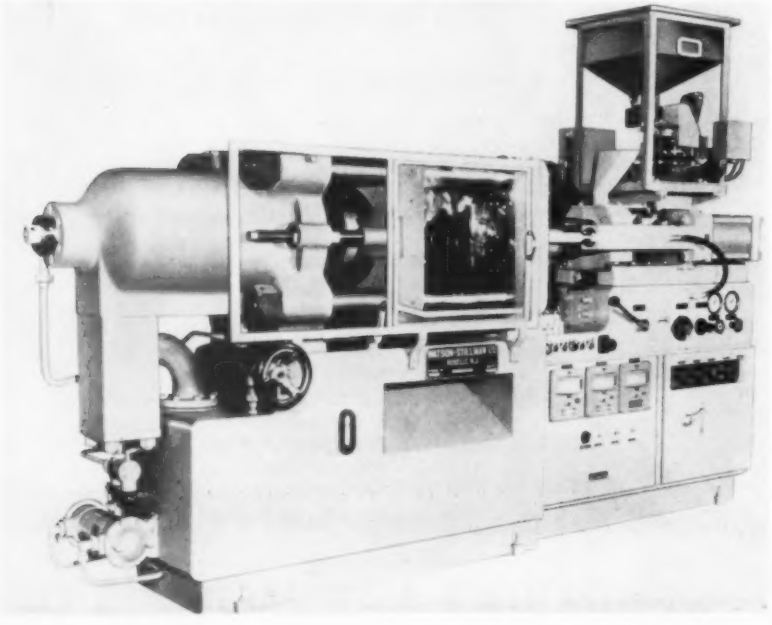
This design is claimed to provide effective r.-f. shielding, to control stop-weld pressure, to prevent the possibility of side-wise tension during the welding cycle, and to eliminate all working-surface obstructions.

Keeper bars can be made either rigid or semi-rigid. No standard sizes are available, each installation being custom-made to a particular application requirement. *Electronic Processes Corp., 1170 San Antonio Rd., Los Altos, Calif.*

Injection Machine—Automatic 5-oz. hydraulic injection molding machine is said to plasticize 80 lb. of styrene per hour. The unit is equipped with an internally heated torpedo which has three controlled heat zones.

The machine is of the straight hydraulic clamp design. Full clamping pressure can be exerted at any point in the stroke, without requiring adjustments for molds of varying thicknesses. Front and rear safety gates are provided.

All controls are located on the front of the machine. The pumping unit consists of two vane-type pumps directly connected to a 25-hp., 1200-r.p.m. motor. Pumps deliver 17.7 and 2.5 g./min., respectively. The machine is normally equipped with self-compensating-type hopper with feed slide. A weigh feeder is optionally available. *The Watson-Stillman Co., Div. of H. K. Porter Co., Inc., 200 Ladene Rd., Roselle, N. J.*



Watson-Stillman's 5-oz. injection machine can plasticize 80 lb. of styrene per hour

Power Unit—Pneumatic prime mover which combines fast action, dampened terminal stopping, high finishing pressure, and full reversibility in one compact three-cylinder assembly, achieves its long stroke and fast operation through pneumatic-cylinder action and its powerful closing force through the differential hydraulic-piston principle. Stroke is 7 in., terminal force is 2100 or 5600 p.s.i., weight is 41 lb., space requirement is less than 1 cu. ft., and air requirement per cycle is less than 0.11 cu. foot.

The unit consists of three cylinders: one for the pneumatic stroke; a second for the 12 to 1 hydraulic multiplication of trapped oil pressure for the finishing stroke; and a third (a booster cylinder), for triggering the high-pressure finish stroke. Provision is made in the second cylinder for minimum drag during the forward stroke, linear deceleration just before the hydraulic stroke, elimination of cavities on return stroke, checking of speed at close of cycle, and independence from changes in oil viscosity due to temperature.

The main stroke speed is adjustable by regulation of the air supply pressure, but does not influence decelerating characteristics. *Pantex Mfg. Corp., 521 Roosevelt Ave., Pawtucket, R. I.*

Safety Equipment —Model TGS 150, designated Silent Sentry, is a device designed to provide safe working conditions to operating personnel on all types of automatic machine tools and equipment, power presses, and belt line assembly systems having cutting blades, in-running rolls, hammers, drills and similar potentially dangerous mechanisms.

The device is equipped with an antenna which is used to form a sensitivity pattern around operating machinery. The pattern may be set to safeguard a limited area or a large area. As soon as any part of a person's body moves into the "protected area," the instrument will stop or

MODEL
H-250

NEW!

VAN DORN
2½ Oz. Automatic Press

Check these outstanding features of this ultra-modern Van Dorn injection press:—

GREATER CAPACITY— Up to 2½ oz.; smaller pieces at faster cycles.

HI-SPEED PERFORMANCE— Plasticizes material at 22 lbs. plus per hour.

FASTER PRODUCTION—Will attain up to 720 cycles per hour (dry run).

HIGHEST EFFICIENCY—Due to water cooling of injection plunger, transfer hopper and oil cooler.

ACCESSIBILITY— Due to simple platen clamp device for purging to change material or color.

MORE SAFETY— Mold hydraulic mechanism makes press non-operative unless molded part is completely ejected.

SIMPLER OPERATION—Due to automatic, adjustable material metering device.

MULTIPLE OPERATIONS—Minimum operator attention by use of larger hopper and light that indicates when press needs attention.

SELECTIVE CONTROL—Merely throw toggle switch to operate press semi-automatically.

DEPENDABILITY— Because of all-steel construction and Van Dorn's established reputation in the plastics machinery field.

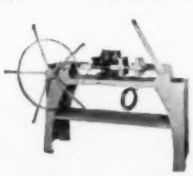
THE VAN DORN IRON WORKS CO.
2687 East 79th Street • Cleveland 4, Ohio
Cable Address: "VANDORN" Cleveland

and this Van Dorn model is the lowest priced press in its class!

WRITE FOR COMPLETE DATA ON MODEL H-250 AND OTHER EQUIPMENT SHOWN

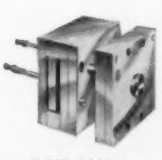
SEMI-AUTOMATIC PRESS
2-oz. capacity.

POWER OPERATED, LEVER CONTROLLED PRESSES
2-oz. and 1-oz. models



MANUALLY OPERATED PRESS
1-oz. For small jobs, training, etc.

PLASTIC GRINDER
Grinds up rejects, waste, etc., for re-use.



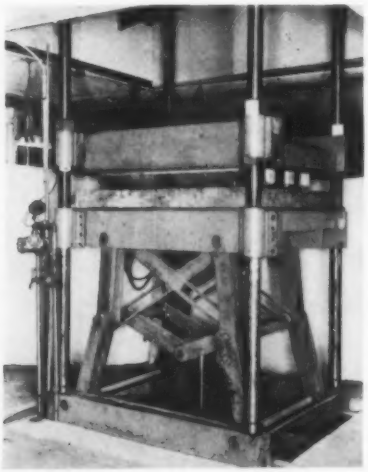
MOLD BASES
Available from stock.

change a machine or operation immediately. Sensitivity of the antenna can be so adjusted that anything approaching within 12 in. of the pick-up plate will actuate the unit, which in turn will stop the machine. If the power source to, or any internal part of, the Silent Sentry should fail, machinery will stop immediately and will remain stopped until the trouble is remedied.

Model TGS 150 operates from a 117-v. a.c. 50- or 60-cycle source, and its output has both normally open and normally closed contacts, so that an external circuit can be used to stop or start machinery and operate other devices. The contacts are said to be able to handle a non-inductive load of 5-amp. 117-v. alternating current. *R. G. Genzlinger, Inc., Neshaminy, Pa.*

Reinforced Plastics Press—Using two platens instead of the customary three, the Wilbrink Press for reinforced plastics molding employs double toggles to obtain high output of pressure with low power input. The design of the patented double toggles combines a long stroke and high speed closing, with nearly all of the pressure being converted in the last few inches of stroke where travel is automatically slowed.

The press is powered by air at 60 to 150 p.s.i., acting through a hydraulic buffer. The platen is 31 by 41 in. or larger. The 34 in. of stroke can be completely closed in five seconds. Daylight opening of 88 in. provides for molding square items 24 in. deep.



John Verduin's reinforced plastics press uses double toggles to obtain high-pressure output from low power input

Pressure is transmitted to the platen by an 8-in. cylinder. The manufacturer of the press states that in a conventionally designed press a 40-in. diameter cylinder would be required to obtain the same distribution of pressure. *John Verduin Machine Corp., 345 Tenth Ave, Paterson 4, N. J.*

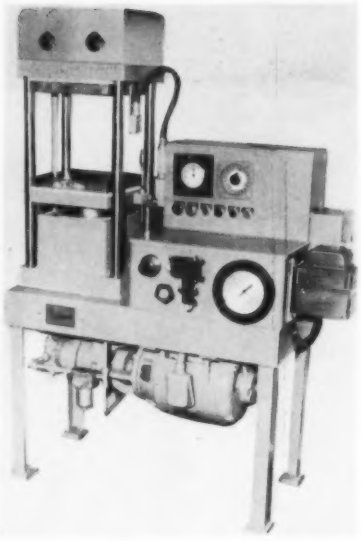
Painting Machine—This oscillating-gun, pressure-contact spray decorating machine, designed for painting areas up to 3 by 6 in., operates in a concave arc, or pendulum-type swing; the gun oscillates continuously to paint either convex or concave surfaces, and the arc can be adjusted to suit the part being decorated. The machine may also be operated with the gun in a stationary position.

The unit occupies a floor space of 34 by 30 in., and is 36 in. high. Mask measures 8 by 4 inches. The machine is self-contained and has a built-in plenum chamber. A built-in air exhaust outlet of 8-in. diameter is said to have a capacity of 900 cu. ft./minute. *Conforming Matrix Corp., 364-3 Toledo Factories Bldg., Toledo 2, Ohio.*

Valve—High pressure combination reducing and automatic relief valve for low-capacity applications is claimed to be usable for initial pressures up to 4000 p.s.i. and reduced pressures from 2000 to 0 p.s.i. in adjustable increments.

The valve, designated Type F, is a spring-loaded, diaphragm-operated unit that can be used with high pressure air, oil, or water. The built-in relief valve automatically opens if reduced pressure exceeds the setting. The manufacturer claims that the pressure reductions are accomplished without shock, that the valve will not leak on tight shut-off, and that variations in initial pressure will have little effect on the reduced pressure. The unit is available in ⅛-, ¼-, ½-, and ¾-in. sizes. *Atlas Valve Co., 280 South St., Newark, N. J.*

Testing Machine—Designed primarily to test the flow characteristics of thermosetting materials by using the A.S.T.M. standard cup mold method, this hydraulic plastics testing machine, when equipped with the proper dies, is said to be capable of also accommodating thermoplastics materials for flow characteristic testing.



Watson-Stillman's testing machine can be adapted for testing flow characteristics of thermosets and thermoplastics

The unit is self contained, including standard heating plates, motor-driven pump, motor, starter, and control panel. Operating pressure is provided by an Oilgear pump directly connected to a 3-hp. flange-mounted motor. Press tonnage is 15 tons, stroke 6 in., operating pressure 2500 p.s.i., platen size 12 by 12 in., and daylight opening 12 inches. The machine weighs approximately 1500 lb., and requires a floor space of 1 ft. 4 in. by 3 ft. 4 in.; height of the testing machine is 4 ft. 9 inches. *The Watson-Stillman Co., Div. of H. K. Porter Co., Inc., 201 Aldene Rd., Roselle, N. J.*

Press Safety—This two-hand electro-solenoid control is intended to improve operating personnel safety in press work. Once this equipment is installed on a press, it is necessary for the press operator to push two mushroom-type buttons in order to trip the press. Both buttons must also be released to trip the press again. The operator cannot hold or tie down one button and trip the press with the other. Thus, both hands of the operator must be out of the danger zone before the press can be set in motion. *Searjeant Metal Products, Inc., 55 Pittsford Rd., Mendon, N. Y.*

CYCOLAC®

THE *New* HIGH-IMPACT THERMOPLASTIC RESIN

Gives your products a NEW DIMENSION for selling!

. . . . and that goes for their manufacture, too . . . . whether you are in the business of manufacturing post-formed business-machine housings, typewriter cases, containers, signs, instrument cases, luggage, vacuum cleaner housings, or what have you. CYCOLAC sheet can be produced by extrusion, calendering or press-polishing. CYCOLAC sheet is tough yet lightweight; it has low shrinkage and can be embossed or grained, solvent-welded, sawed, drilled, buffed, painted, etc., ... and it's so colorful, too!

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CYCOLAC — the one uniform resin that makes good products BETTER

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MARBON CORP.

GARY, INDIANA

SUBSIDIARY OF BORG-WARNER

MARBON . . . . Precision Resins for Precision Made Products

Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTICS AND SYNTHETIC RESIN PRODUCTION
From Statistics Compiled

Materials	*Total p'd'n. first 8 mos. 1954*	*Total sales first 8 mos. 1954*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester		
Sheets, under 0.003 gage	11,387,031	11,380,335
Sheets, 0.003 gage and over	7,594,711	8,025,795
All other sheets, rods, tubes	3,589,434	3,280,392
Molding, extrusion materials	47,383,167	46,191,483
Nitrocellulose sheets, rods, tubes	3,926,649	3,349,463
Other cellulose plastics	3,599,874	3,224,358
PHENOLIC AND OTHER TAR-ACID RESINS:		
Molding materials[a]	117,602,020	107,861,914
Bonding and adhesive resins for:		
Laminating (except plywood)	41,651,124	28,406,619
Coated and bonded abrasives	6,132,948	6,725,644
Friction materials (brake linings, clutch facings, etc.)	9,754,460	9,359,126
Thermal insulation (fiber glass, rock wool)	22,147,759	23,007,325
Plywood	17,333,714	16,816,042
All other bonding and adhesive uses	8,736,208	8,879,507
Protective-coating resins	15,555,377	14,521,024
Resins for all other uses	17,257,396	15,088,290
UREA AND MELAMINE RESINS:		
Textile-treating and textile-coating resins	23,145,804	20,240,340
Paper-treating and paper-coating resins	12,468,327	11,651,720
Bonding and adhesive resins for:		
Plywood	48,965,464	45,742,966
All other bonding and adhesive uses, including laminating	14,947,123	14,028,355
Protective-coating resins	17,757,377	13,393,535
Resins for all other uses, including molding	43,365,483	41,153,822
STYRENE RESINS:		
Molding materials[a]	204,630,581	199,478,811
Protective-coating resins	58,509,797	54,468,073
Resins for all other uses	62,010,191	58,669,235
VINYL RESINS, total[b]	326,965,439	329,769,431
Polyvinyl chloride and copolymer resins (50 percent or more polyvinyl chloride) for:		
Film (resin content)		45,911,925
Sheeting (resin content)		39,205,615
Molding and extrusion (resin content)		91,153,636
Textile and paper treating and coating (resin content)[c]		32,786,823
Flooring (resin content)		19,504,738
Protective coatings (resin content)		15,038,760
All other uses (resin content)		20,232,303
All other vinyl resins for:		
Adhesives (resin content)		18,365,232
All other uses (resin content)		47,317,737
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS	117,753,437	128,249,866
MISCELLANEOUS:		
Molding materials[a, d]	121,909,911	116,143,794
Protective-coating resins[e]	5,079,962	2,529,961
Resins for all other uses[f]	77,732,788	79,464,370

* Dry basis is designated unless otherwise specified.
** Partially estimated. † Revised.
[a] Includes fillers, plasticizers, and extenders. [b] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production are given. [c] Includes

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS* FOR JULY AND AUGUST 1954
by U. S. Tariff Commission

*July***		*August***	
Production	*Sales*	*Production*	*Sales*
918,715	1,222,603	1,423,567	1,409,289
695,980	843,608	1,082,636	1,251,157
278,906	332,905	456,236	416,497
5,192,869	5,348,884	7,133,795	6,487,904
270,637	282,263	366,199	385,028
370,725	484,393	547,995	495,594
8,583,130	9,226,494	12,768,543	14,408,361
4,142,590	3,113,465	5,633,633	4,032,318
532,801	689,308	811,449	954,683
979,452	942,481	1,393,804	1,294,963
3,370,044	3,611,053	3,248,087	3,380,977
922,392	1,055,269	1,653,848	1,548,084
932,176	997,813	976,624	975,701
†1,663,625	†1,559,273	1,952,168	1,795,773
†2,217,114	†1,796,001	2,337,735	2,358,985
†1,962,877	†1,999,045	2,939,021	2,841,477
1,324,096	1,401,405	1,304,618	1,685,627
5,208,955	5,548,279	6,821,559	6,643,682
1,397,707	1,646,684	1,623,334	2,018,149
2,166,442	1,701,198	2,130,719	1,749,489
3,477,363	4,039,810	5,384,655	5,735,218
21,522,041	19,635,780	25,411,595	25,939,434
†8,143,533	†7,319,874	8,463,336	6,661,817
6,563,740	6,384,561	6,396,899	6,036,276
†36,485,567	†36,081,612	34,341,275	48,183,463
	5,114,108		7,077,521
	3,440,888		4,522,252
	9,647,627		14,541,061
	3,104,778		4,258,936
	3,356,248		3,931,364
	1,858,661		2,197,558
	2,597,983		3,406,925
	†1,951,339		2,443,836
	5,009,980		5,804,110
13,331,241	14,017,283	19,184,076	19,768,567
13,103,788	11,509,896	15,857,618	16,220,515
335,016	255,847	377,465	279,846
†9,237,882	†10,689,883	10,723,498	12,411,800

data for spreader and calendering-type resins. [d] Includes data for acrylic, polyethylene, nylon, and other molding materials. [e] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective-coating resins. [f] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

Plastics Insulation

(*From pp.* 87-92)

use is restricted to applications in which operating temperatures do not exceed approximately 175° F. Moldability, in combination with other properties, makes this new Koppers' foam ideally suited for such insulation applications as refrigerator cars and trucks, low temperature industrial piping, refrigerator evaporator chests, general refrigerator insulation, air conditioning units, etc. Using this material, it is possible to mold insulation to fit intricately shaped cavities, eliminating fabrication.

The most efficient method of heating the styrene beads to accomplish foaming is by direct injection of dry steam into the mold cavity through small holes drilled in the cavity walls. Since the material is thermoplastic, it must be cooled to a temperature of 120 to 125° F. before opening the mold to prevent continued expansion after removal from the mold.

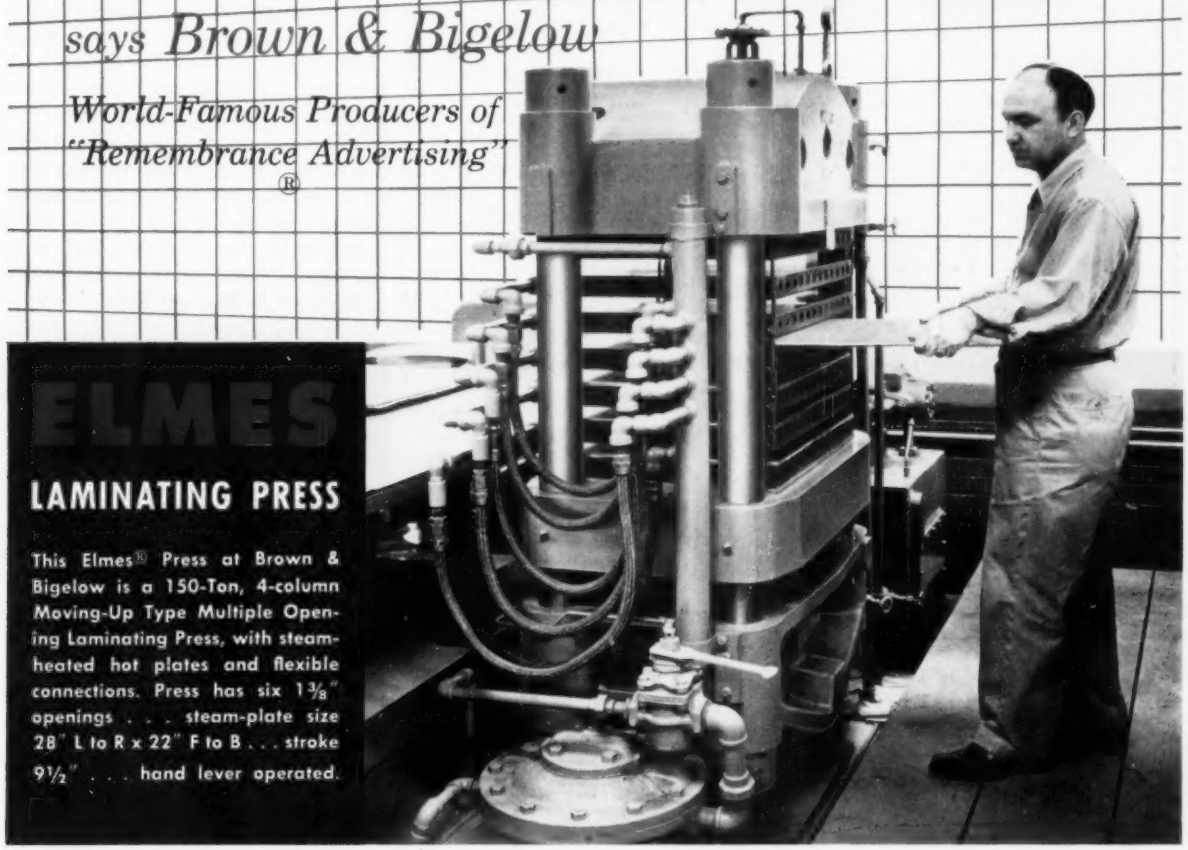
CELLULOSE ACETATE: Another plastic foam material having excellent thermal insulating properties is Strux, a cellular cellulose acetate manufactured by Strux Corp., Lindenhurst, L. I., under license from E. I. du Pont de Nemours & Co., Inc. Produced by an extrusion process in boards up to 1 by 4 in. in cross section and in rods up to 2¼ in. in diameter, Strux (also known as CCA) is an expanded plastic composed of non-interconnecting cells which give the material excellent insulating qualities. Absence of plasticizer in Strux results in excellent temperature stability; it may be subjected to temperatures as high as 350° F. for long periods and even higher temperatures for shorter periods, particularly when used in combination with fibrous glass laminates. The material weighs from 4 to 8 lb. per cu. ft., depending upon composition and porosity and has a compressive strength of approximately 150 p.s.i. Thermal conductivity (K value) ranges from 0.31 for the CH-167 formulation to 0.32 for CH-178.

Easily bonded to glass cloth, glass mat, metal, or wood with polyester and other resins, Strux lends itself to production of laminated sandwiches in which it contributes in-

"results are MOST satisfactory... press is Highly Versatile for our Laminating Work"

says *Brown & Bigelow*

World-Famous Producers of "Remembrance Advertising"®



ELMES

LAMINATING PRESS

This Elmes® Press at Brown & Bigelow is a 150-Ton, 4-column Moving-Up Type Multiple Opening Laminating Press, with steam-heated hot plates and flexible connections. Press has six 1⅜" openings . . . steam-plate size 28" L to R x 22" F to B . . . stroke 9½" . . . hand lever operated.

The Elmes Press pictured above is used in the processing of calendar cards, blotters, plastic rulers and for laminating cards at the Brown & Bigelow East Hennepin Plant. It is a typical example of the complete line of compression type presses manufactured by Elmes—presses used in curing high-pressure individual sheets and decorative laminates.

Steam-heated "hot plates" are made from 2" up to 4" thick, depending upon the particular press. Since the platens of multiple platen laminating presses must be heated and cooled, they are cored for circulation of steam and cooling water. Flexibility of steam and water lines, required by the movement of platens, is provided by flexible hose connecting to a main pipe header.

In the pressing operation, a stainless steel caul plate is used on either side of the stack of treated material. Several stacks, separated by caul plates, may be loaded between each two steam platens of the press.

A formal proposal to suit your particular requirements, or further information, will be promptly supplied on request. Get in touch with your Elmes distributor or write to us direct.

AMERICAN STEEL FOUNDRIES

ELMES ENGINEERING DIVISION

hydraulic presses and equipment ....1159 TENNESSEE AVE., CINCINNATI 29, OHIO

creased strength and stiffness without correspondingly increasing the weight. As a core in this type construction, it may be used for floor and wall panels in aircraft, boats, trucks, and refrigerators.

Additional characteristics of the cellular cellulose acetate material include high dielectric and structural strength, unusual buoyancy in water, oil and other liquids, good acoustical insulation properties, and resistance of fungi and decaying influences.

VINYL FOAM: Several types of thermoplastic foams based on polyvinyl chloride are now in production by various suppliers. One such product is Aer-O-Buoy vinyl foam, made by Robinson Moulded Products, Ltd., Toronto, Ont., and available in both flexible and rigid types. In its rigid form, the foam has high insulating properties and is impermeable to moisture. Its low thermal conductivity and density are relatively unaffected by temperature and moisture changes. As thermal insulation, Aer-O-Buoy is used primarily for low-temperature work, such as cold storage rooms, dairies, testing laboratories, refrigerated trucks and railway cars, shipping and storage containers, and home and commercial freezers. In many instances, insulating panels of wood with a core of the vinyl foam can eliminate the use of heavy steel construction. The light weight of the material is particularly desirable in such applications as large doors for aircraft hangers.

Aer-O-Buoy foam can be readily bonded to wood, metal, glass, and other materials. The material is not easily damaged and may be installed by unskilled labor; fabrication of the product, ranging from ¼ in. to 2 in. in thickness, is by means of ordinary carpentry tools working at temperatures up to 160° F. Thermal conductivity of Aer-O-Buoy insulation materials, also widely used in flotation applications, is 0.27 at a mean temperature of 63°F. A complete vapor barrier in itself, this foam is fire resistant and not affected by corrosion, rot, or vermin. Other characteristics include high tensile strength and electrical resistance and resistance to gasoline, oil, and commercial acids. In its flexible form, the Aer-O-Buoy material is widely used for shock absorption,

gasketing, and weatherstripping purposes.

The Sponge Rubber Products Co., Shelton, Conn., has been a pioneer producer of vinyl foam material. One interesting product made by this company which demonstrates the effectiveness of vinyl foam as a thermal insulating material is the "n'Icer" bucket, molded of cellular vinyl chloride. Sufficiently flexible that its sides may be pressed in to squeeze clustered ice cubes apart, the bucket is so efficient from the insulation standpoint that even after a four-hour period, ice cubes lose only 10% of their original size.

This foamed vinyl material is produced through the use of a non-toxic chemical blowing agent, and can be made in a wide range of densities. It is produced in sheet form or in molded shapes. The latter, made on standard compression presses, utilize "undersize" molds with cavities the exact shape of the form to be molded. The molding material—a plastisol plus a blowing agent (Celogen)—is placed in the mold and pressure applied. After removal from the mold, the object "grows" upon further application of heat, maintaining the original shape and proportions.

Vynafoam, a plastisol material produced by the Finishes Div., Interchemical Corp., is utilized by Nash-Kelvinator Corp. in a refrigerator service door[2], providing ease of application and a tight reclosure when the door is removed and replaced. In addition to the gasket field, this material, which cures rapidly without use of molds and expands to final dimensions through controlled application of heat, can be sprayed on the inside of housings for air conditioners, business machines, etc., to provide both thermal and acoustical insulation. Vynafoam has a K value of 0.36, or about equal to that of balsa wood.

Ensolite, produced by United States Rubber Co., Mishawaka, Ind., is an expanded, unicellular modified polyvinyl chloride compound. Combining exceptionally low thermal conductivity with outstanding shock absorption, unusually low water absorption, and excellent vibration dampening and sound deadening, along with high resistance to common chemicals, Ensolite is finding a wide variety of applications in many fields. The material has a density of 4 to 6 lb./cu. ft. for soft types and 6 to 8 lb. for harder shock absorbing types. Widely used as athletic padding, Ensolite in the Type C formulation has a K value of 0.23 to 0.26, comparing favorably with the best insulating material previously available and far superior to most others. This property is of prime importance in outdoor clothing and equipment applications. The material is being utilized successfully in a variety of boots, pacs, insulated shoes, etc.

Since Ensolite absorbs only an insignificant amount of water, even on continuous immersion, its insulating qualities cannot be impaired from outside weather or surface water or from inside perspiration. Neither will the light weight and flotation qualities of Ensolite be affected in any way by prolonged exposure to driving rain or by actual immersion in water.

Proved in extensive field trials and wide military usage, Ensolite is being used exclusively for the Quartermaster Cold Bar suit, developed for use in wet, cold climates. This suit has come through large-scale winter trials very successfully and has also proved valuable for its flotation characteristics as well as its outstanding cold protection properties. Type C Ensolite has also been made into a variety of civilian clothing items, such as insulated rainwear, firemen's coats, hunting jackets, sleeping bags, bed quilts, etc., as well as numerous types of military and civilian boots and shoes.

COPOLYMER: Another form of thermoplastic having interesting thermal insulating properties is expanded Royalite, also produced by U. S. Rubber. Technically, this is a chemically expanded, unicellular copolymer of butadiene-acrylonitrile and styrene-acrylonitrile, together with the necessary catalysts, modifiers, and emulsifying agents. In addition to its utility as thermal insulation, expanded Royalite finds application for high impact energy absorption, as a flotation material, and for equipment housings where electrical insulation is a requirement.

The efficiency of expanded Royalite as thermal insulation stems from its relatively low thermal conduc-

[2] See "Vinyl Foam Makes Better Gaskets," Modern Plastics, *31*, 80 (July 1954).

tivity, coupled with low moisture absorption. In addition, the material is virtually unaffected by weather or by fungi which cause dry rot, and can be obtained in very light densities.

Standard formulation expanded Royalite is available in 46- by 70-in. sheet sizes in ¼-, ½-, ¾-, and 1-in. thicknesses, having a density of approximately 8 lb. per cu. foot. In applications where fire resistance is required, the material is available in a self-extinguishing formulation. Also, where strength requirements exceed those possible with the standard formulation, it is possible to obtain an integral laminate composed of an expanded Royalite core and a solid Royalite outer skin. Thermal conductivity of expanded Royalite ranges from 0.266 for the fire-resistant formulation to 0.32 for the standard material.

Among other insulating applications of this material is its use in the construction of a military food container made for the Quartermaster Corps by Knapp-Monarch Co., St. Louis, Mo. In this container, designed to expedite troop feeding operations in forward areas, shredded urea foam is employed as the principal insulation medium between the metal inner and outer walls, with three blocks of expanded Royalite used at the bottom to maintain the distance between these two parts.

PHENOLIC: Westinghouse Electric Corp. is one supplier of a phenolic foam material which can be foamed in place for such applications as insulation for refrigerator doors. The material is described as having a density range of 0.6 to 2 lb. per cu. ft. and a K factor of 0.20 to 0.30.

One of the outstanding characteristics of phenolic foam, though not unique with this material, is its ability to convert from a liquid resin to an expanded solid in a matter of minutes, without the addition of external heat or pressure, and the fact that the expanding material will assume the shape of the cavity in which it is formed. The foams are made from the liquid resins through addition of a chemical blowing agent that expands the resin up to 300 times the volume it had in its unfoamed state.

Although early predictions by some enthusiasts that "tomorrow's homes may be insulated with phenolic foam, just as simply as an oil dealer now fills the home fuel-storage tank" still appear far from realization, this material has found its way into various types of applications where its thermal insulating properties, plus light weight, successfully met the requirements. Particularly desirable as a package cushioning material where delicate instruments and similar parts must be protected, phenolic foam has been successfully used as an insulating material in lightweight, low-cost reusable containers for air shipment of whole blood. Thanks to the insulating properties of the material, the containers, cooled by chopped ice, can be maintained at a temperature of between 33 and 49° F. for a period of 24 hr. without re-icing. The shipping containers, produced by Bailey Engineering Co., Ramsey, N. J., utilize a 3-in. thickness of phenolic foam sandwiched between inner and outer boxes of corrugated kraft board. The phenolic resin used for these containers, foamed by Thermofoam Corp., Metuchen, N. J., from Bakelite material, is supplied in

slabs that are easily cut to the required size.

With the development of some of the newer types of foamed-in-place materials and other plastics which may be foamed to ultimate shape in heated molds, the future of phenolic foam as a thermal insulating material does not at present appear to be particularly promising. One major supplier of phenolic foam material reports that its own product is not being used for this type of application at the present time. Whether phenolic will ultimately come back into the thermal insulation picture and become a strong contender in this field remains to be seen.

UREA: Urea foam, originally developed by U. S. Rubber and initially marketed by that organization, is now manufactured by Colton Chemical Co., Cleveland, Ohio, under the trade name of Colfoam.[8] Having a density of only 0.8 lb. per cu. ft., this material exhibits a K factor of 0.18 at 75° F., making it one of the most efficient insulating materials available, particularly in installations in which minimum weight and space saving are essential.

In the production of Colfoam, soluble resins are transformed into a liquid, then frothed to produce a light, snow-white fluffy mass, quickly gelled to capture the multicellular structure, then permanently set and later dried thoroughly to solidify the mass again. The material resulting from this process has an interwoven crystalline texture containing approximately 99% trapped air by volume. Density of the material can be varied to meet specific requirement applications by increasing or decreasing the percentage of solids present.

While developed originally in the face of military necessity as a flotation material, Colfoam is used for a variety of practical applications in low temperature insulation, including household and commercial refrigeration units, frozen food shipping containers, transportation refrigeration in trucks, railway cars, aircraft or marine vessels, and for permanently installed building refrigeration units. Satisfactory for use with sustained temperatures up to 120° F., Colform is chemically in-

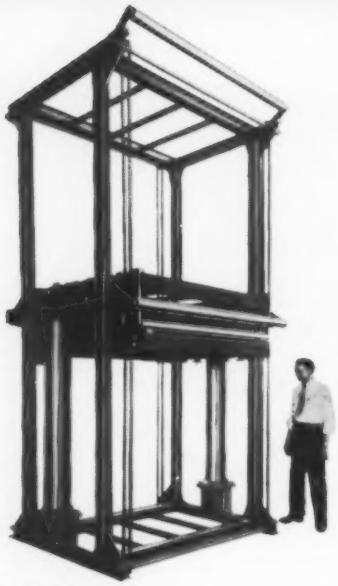
(*To page* 206)

[8] See "3 New Foams," Modern Plastics *30*, 85 (April 1953).

ADAMSON UNITED

Rubber..... AND Plastics

CALENDER ACCESSORY EQUIPMENT



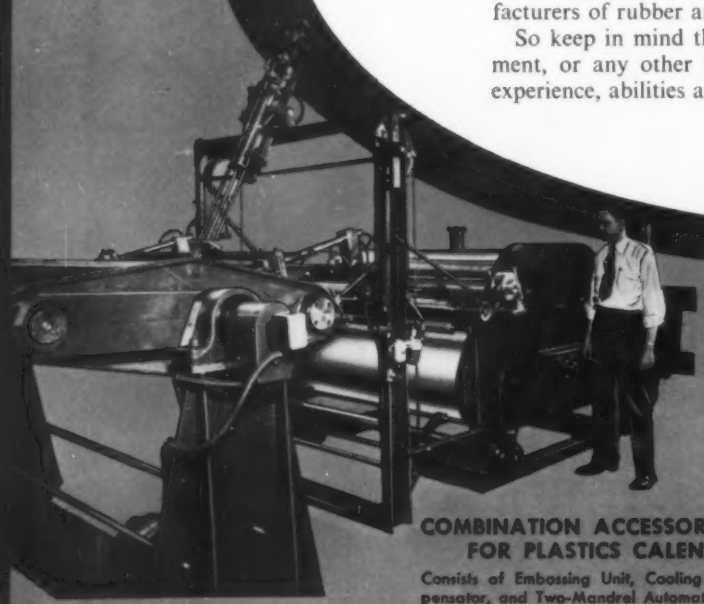
FESTOONER

A double-acting unit for handling various types of fire cord. It is used in conjunction with high-speed precision calendering equipment to store fabric while the let-offs or windups are stopped for roll changes.

Adamson not only engineers and builds a complete line of standard and special calenders, but in addition can supply all types of Calendering Accessory Equipment required for the continuous processing of rubber or plastics. Where special equipment is needed, our engineers are available to work with you in the development, design and construction of the right machinery or process to meet your requirement.

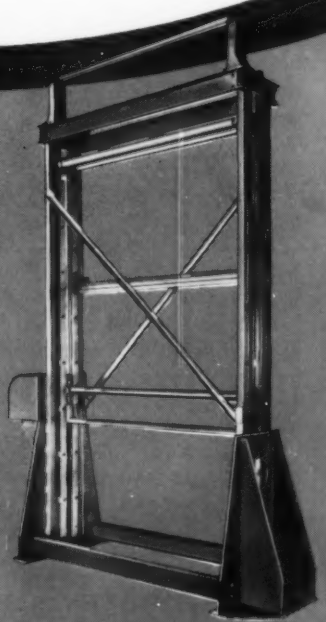
For over 60 years Adamson has pioneered in the advancement of rubber processing techniques, and today is a major supplier of equipment to manufacturers of rubber and plastics products the world over.

So keep in mind that whether it's Calenders, Calender Accessory Equipment, or any other type of rubber or plastics processing machinery, our experience, abilities and manufacturing facilities are at your service.



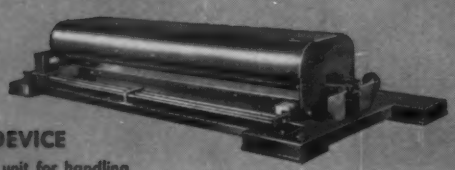
SINGLE ROLL COMPENSATOR STAND

For coordinating the speed of various elements in a calender train.



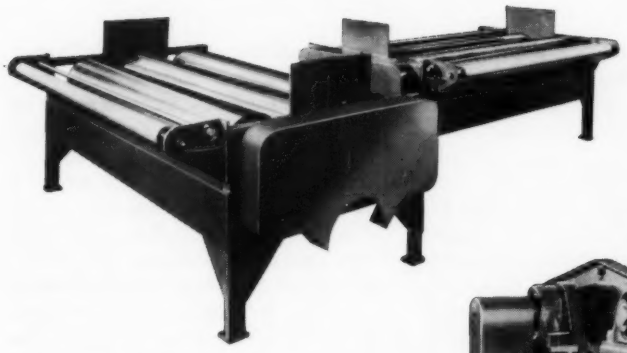
COMBINATION ACCESSORY TRAIN FOR PLASTICS CALENDER

Consists of Embossing Unit, Cooling Drum Stand, Compensator, and Two-Mandrel Automatic Turret Windup.



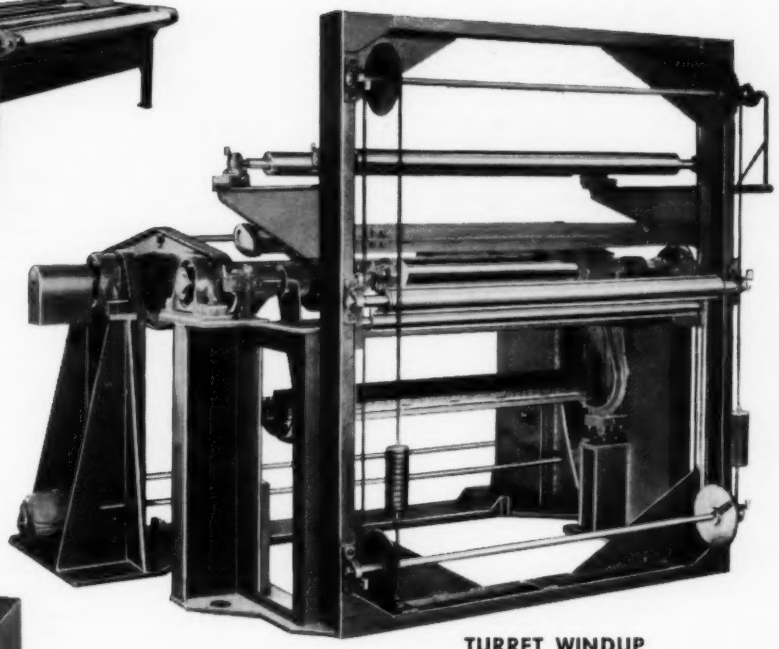
FABRIC CENTERING DEVICE

A rugged, 3-roll motor-driven unit for handling fire cord prior to its entry into the calender.



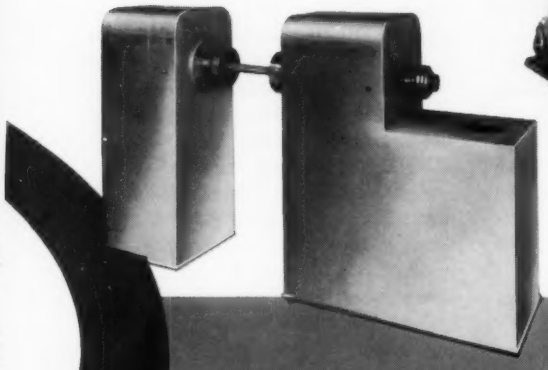
SURFACE WINDUP UNITS

Simple, conventional, drum-type windups for handling plastic film, plastic sheeting and coated fabrics.



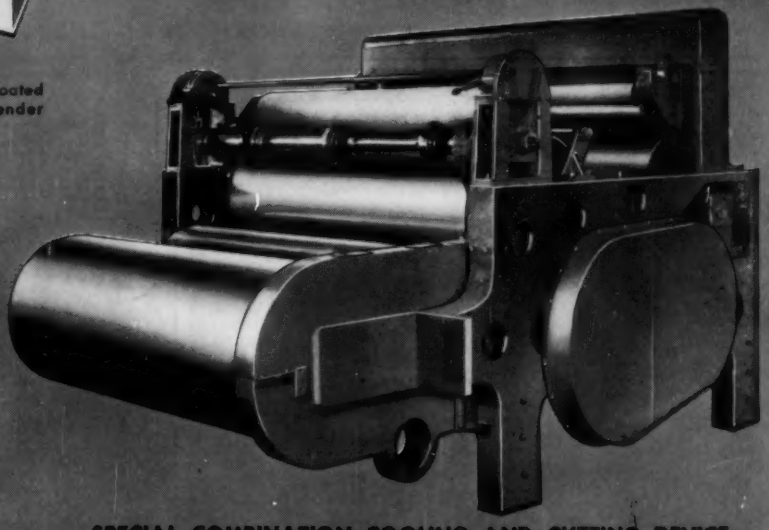
TURRET WINDUP

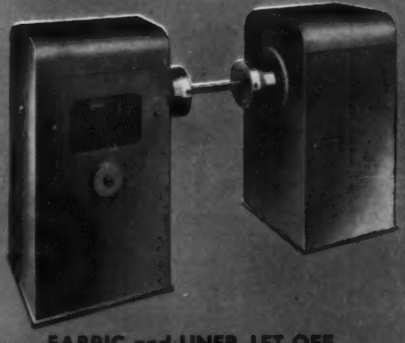
A special, center-drive windup designed specifically to wind very thin plastic film under accurately controlled, minimum tension. Equipment includes Two-Mandrel Turret, Automatic Counter and Cutting Device.



SIMPLE WINDUP STAND

Motor driven type for winding of coated fabric. Floor mounted type. Calender mounted units are also available.





FABRIC and LINER LET-OFF

Friction type, used in handling fabric for 3-roll universal calenders or for 4-roll double-coating calenders.

SPECIAL COMBINATION COOLING AND CUTTING DEVICE for RIGID PLASTIC SHEETING. Used with 4-roll calenders, with gear ratio changing equipment, to modify length of cut. Trim chopping device included.

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ert under low-temperature conditions and not affected by long exposure to extreme refrigeration conditions. Odorless and mildewproof, the urea foam does not support mold or bacteria growth. Under exposure to high relative humidities for extended periods, Colfoam absorbs not more than 20% of its own weight; however, direct contact with water is to be avoided in insulation applications and for ideal performance the insulated space should be hermetically sealed.

Supplied in block, slab, and shredded form, the material is easily installed in regular or irregular spaces. It may also be surfaced with paper, cloth, or resin coatings or prepackaged to expedite particular installations. Plastic coated Colfoam blocks greatly reduce the moisture absorption of the material without appreciably changing its thermal properties or affecting its density to any significant degree.

Blocks of urea foam have been used as the insulation material in refrigerated showcases made by the Weber Showcase & Fixture Co., Inc., Los Angeles, which company states that the material is lighter in weight and easier to handle than fibrous glass. In shredded form, urea foam is utilized in the Quartermaster Corps insulated food container mentioned earlier.

ISOCYANATES: If and when the foamed refrigerator or freezer reaches the production stage, one of the new isocyanate foams[4] may turn out to be the type of plastic used. Since they are prepared as pourable liquids, these materials are particularly adapted to filling either regular or irregular cavities in installations calling for light weight, high strength, and vibration dampening characteristics. As the pourable liquid turns to a dough-like mass and increases in size, carbon dioxide evolves and forms the cells which give the material its foamed characteristics.

The original liquid mixture can be readily poured into cavities where it will expand and bond to the inside surface; it can also be drawn by vacuum through openings too small for normal pouring.

The fact that expanded plastics utilizing isocyanates show good adhesion to wood, primed metal, fibrous glass laminates, and fabrics when formed in contact with such surfaces eliminates many difficult cementing operations in a given assembly.

Goodyear Aircraft Corp. was an early producer of alkyd isocyanate foams, using them to form a molded core in conjunction with polyester-glass fiber laminates for applications involving critical electrical requirements. Lockfoam, produced by Lockheed Aircraft Corp., Burbank, Calif., is another isocyanate material which has been widely used in aircraft construction as a foamed-in-place product.

Armofoam I, a product of the Adhesives Div. of Armour and Co., Chicago, Ill., is that company's latest development in a series of new polyisocyanate foamed-in-place, self-curing, low-density foams. During the foaming process, this material fills the cavity regardless of shape and bonds well to its walls during cure. Bonding to most metals, plastics, wood, glass, and ceramics is good. Exceptions to bonding under these conditions are polyethylene, polyvinyl chloride, and Teflon. Armofoam I can be supplied in

[4] See reference 3.

formulations to produce resilient foams of 2 lb. per cu. ft. density up to rigid foams with densities of 20 lb. per cu. foot. High strength, good thermal stability, insolubility in water and most petroleum products, and good thermal, acoustical, and electrical insulation properties are among the outstanding characteristics of the material. These properties recommend Armofoam I for use in filling parts for structural reinforcement, sandwich construction, insulation of both high and low temperature lines, and refrigerating equipment.

In addition to conventional mixing and pouring techniques, methods for rapid application of Armofoam I by continuous mixing and spraying equipment may be used if desired. Using a dual spray gun, it is possible to cover plain surfaces with foam at the rate of 3 sq. ft. per minute. A 1/16- to 1/8-in. layer of mix sprayed on a surface will expand to give approximately 1 in. of foam insulation. A hard skin with less air and moisture permeability is formed on the top of the surface, providing added protection.

Thermal insulating properties of Armofoam I having a core density of 2 lb. per cu. ft. is indicated by a K value of 0.20 at −10° F., 0.26 at 77° F., and 0.30 at 140° F. Maximum temperatures recommended are 212° F. for continuous use and 250° F. for intermittent use. Water absorption of the foam after exposure to conditions of 100% relative humidity and 77° F. for periods from 7 to 28 days was 3.7 percent. Aging properties and general chemical resistance are described as good.

Emerson & Cuming, Inc., Canton, Mass., manufactures two types of isocyanate foams—Eccofoam S and Eccofoam FP. Eccofoam S, a new series of plastic foam products, is a low-density, rigid, unicellular thermosetting material available in a range of bulk densities from 3 to 25 lb. per cu. ft., normally supplied in 18- by 30-in. sheets with a thickness of 1, 2, or 3 inches. It can be used at temperatures as low as −94° F. without physical deformation and will not flow even when subjected to temperatures as high as 304° F., although softening occurs at high temperatures and physical properties are somewhat impaired.

Eccofoam FP is a foam-in-place liquid resin which, upon addition of

a catalyst, expands and cures to a rigid thermosetting unicellular foam of specified density. It can be processed completely at room temperature. Due to the very low exotherm developed during cure of the material, volumes of several cubic feet of excellent structure can be made in one pouring. The material is now being regularly used for thermal insulation, particularly in connection with electronic equipment.

The excellent adhesion of Eccofoam FP to a wide variety of materials is of value when the cured foam is to remain in the cavity.

SILICONE: Although silicone foams are still essentially in the experimental stage, results obtained with them to date suggest that for insulation applications involving elevated temperatures, no other presently known type of plastic foams can approach them. Since the top continuous operating temperatures of most thermoplastic materials is around 200° F., while the thermosets are limited to about 350° F., the majority of thermal insulation applications of plastic foams and other forms of plastic materials are of the low-temperature variety, or within the so-called "comfort insulation" zone.

Recently, the Air Force has been investigating the possibility of developing new low-density resinous foamed-in-place core materials having the desirable physical properties of the organic foams, plus sufficient thermal stability to be used continuously at 500° F. and intermittently at even higher temperatures. Out of this investigation, conducted in cooperation with Dow Corning Corp., have emerged two resins identified as XR-543 and XR-544, both of which produce exceptionally heat-stable foams having a wide range of controlled densities. They may be cast in blocks or sheets, made up as sandwich structures, or foamed in place. Although developed primarily for use in aircraft and guided missile applications, these foams may prove to have a broad potential in thermal insulation.

The heat distortion temperature of silicone foams has been determined to be between 700 and 800° F. The excellent thermal insulating properties of these silicone foams is indicated by the fact that for a density of 11 lb. per cu. ft., the K value of 0.3, obtained in tests, is comparable to that of expanded polystyrene having a density of 2 lb. per cu. foot. Water absorption after 300 hr. was determined to be 5.2% by volume.

The Future

The foregoing gives a birds-eye view of plastics as thermal insulation materials. Despite spectacular progress in some areas, the surface has barely been scratched. Traditional materials such as asbestos, cork, mineral wool, wood fibers, and others are well established in the field. They do a good job but for many applications plastics have much more to offer. Their versatility alone is provocative to designers and engineers who look beyond the horizons, who dare to break with tradition, who envision thermal insulation as something more than a necessary evil to be incorporated in conventional structures from refrigerators to houses, from ice buckets to complicated industrial processing equipment. In the hands of such men rests the future of plastics in thermal insulation.—END

Plastics Meetings

(*From page 93*)

cided that a new working group on the preparation of test specimens is also to be organized.

The British Standards Institution and the British Plastics Federation were hosts at a dinner for the delegates on October 7. Brief talks were given by Sir Roger Duncalfe, President of the B.S.I.; A. E. Skan, Chairman of the B.P.F.; J. E. Hay, Deputy Mayor of Brighton; H. V. Potter; and G. M. Kline. The 1955 meeting of ISO/TC 61 will be held in Paris. The exact date of the meeting has as yet not been determined, but will probably fall sometime in July.

IUPAC Macromolecular Symposium

The Symposium on Macromolecular Chemistry in Milan and Turin was attended by about 200 scientists from 17 nations, including about 15 from the United States. Approximately 80 papers were presented; these will be published in booklet form by the Italian National Research Council and will be available in the United States through Interscience Publishers, Inc. During the meeting, H. Staudinger of Freiburg, Germany, who was awarded the 1953 Nobel prize for his work in the field of polymer chemistry, received an honorary degree from the University of Turin. Hermann Mark of Brooklyn Polytechnic Institute, Chairman of the IUPAC Macromolecular Commission, was presented with the Medal of the Milar Polytechnic Institute; this is the first time the medal has been awarded to a non-Italian. The next meeting of the Macromolecular Commission will be in Zurich, Switzerland, on July 20 to 28, 1955. The IUPAC Division of Plastics and High Polymers, Applied Chemistry Section, will also meet in Zurich during the same period.

International Congress

The 6th International Plastics Congress and the 4th International Technical Exhibition, including a section on plastics, were held in Turin concurrently with the IUPAC Macromolecular Symposium. Manlio Muzzoli presided as chairman of the Plastics Congress. The first session was devoted to a discussion of plans for the formation of an Italian Plastics Institute. Other sessions dealt with the development of standards for plastics and the applications of plastics in the agricultural, architectural, and automotive industries. The Plastics Exhibition included displays by Dutch, German, and Swiss firms in addition to those of the Italian firms. Machinery for processing plastics was given special prominence.

German Plastics Meeting

The 1954 Kunststoff-Tagung in Stuttgart was attended by over 1500 registrants, of whom approximately 10% were from countries other than Germany. This large attendance at this annual plastics technical meeting, held under the auspices of the Society of the German Plastics Industry and various technical organizations, is indicative of the growth of the industry in Germany. It is now the world's second largest producer of plastics; some comparative statistics on the production of plastics for East and West Germany, the United States, and the world, distributed at the meeting, are presented in Table I, page 93.

The 26 papers relating to the economics, chemistry, physics, and technology of plastics, which were delivered at this meeting, will appear in the November and December issues of *Kunststoffe* magazine. Special sessions were devoted to developments in polyester and foamed plastics and to vacuum forming and extrusion molding. Karl-Heinz Hellwege, director of the German Plastics Institute at Darmstadt, reported on the research program which will be conducted at this newly established institution.

The German plastics industry is planning another comprehensive exhibit at Düsseldorf during the period October 8 to 16, 1955, following up the very successful educational job done in 1952. The exhibitors will include manufacturers of plastics materials, finished products, and machinery. Manufacturers in countries outside of Germany will be limited to exhibits of machines, equipment, or tools for the production of processing of plastics. A special "neutrally designed" exhibition section will show a careful selection of plastics products arranged according to use and the main types of equipment in which the materials are converted into finished products.—End

Miniatures

(*From pp.* 96-99)

moving conveyor, which carries it to the next operator.

Simultaneously, body assembly proceeds on the opposite side of the line. Die-cast headlights, tail lamps, and front grille are press-fitted into cores in the body. The next body assembly operation involves mounting the green-tinted inner shell which forms all window areas, including the windshield. This Nash part is made in a special mold; a slightly different shape and size of inner liner is used interchangeably in several of the other models. The use of the one-piece window molding avoids the necessity of applying individual pieces of transparent plastic to the windows.

Special Cementing Job

At this point on the assembly line, the Nash body is snapped in place on the chassis. Short lugs extending from the bottom of the body at front and back are inserted through slots in the chassis, insuring proper alignment of body and frame. Next, the model is pressed down on a special cementing unit which actuates two jets, squirting a small quantity of acetone inside the body, along each side. The solvent flows by gravity into the interlocking side seam between body and chassis, located beneath the doors of the car. Models are then placed on a turntable equipped with a number of toggle clamps which exert pressure on the top of the cars while the body joints are drying.

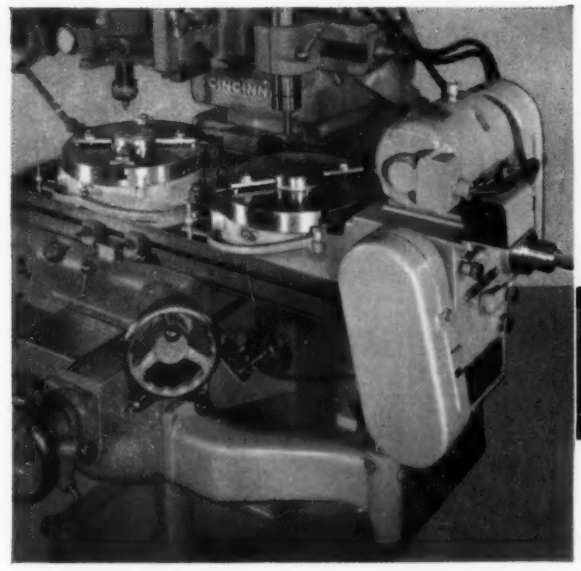
At the end of the Nash assembly line is the operator who handles final inspection and packaging. This operator also applies a small amount of acetone to the front and rear body joints on the underside of the car. Models are checked for proper assembly and motor operation before packaging. The speed of the entire Nash line is such that a model progresses from the beginning of the line to final inspection and packaging in approximately nine minutes. Substantially the same assembly procedure is followed for other models.

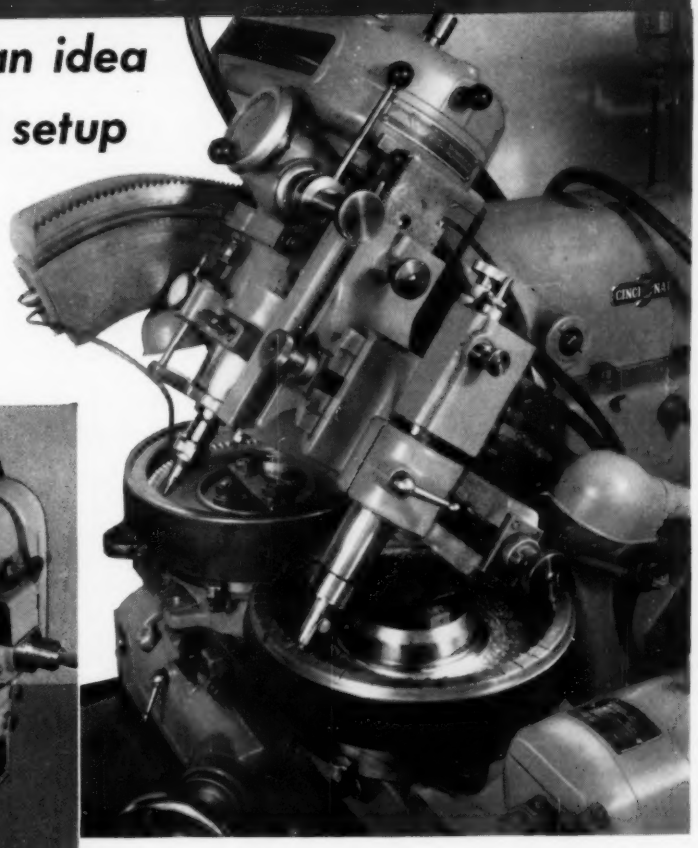
Somewhat unusual from both the design and construction standpoint is a relatively new model known as

Ideas are where you find them

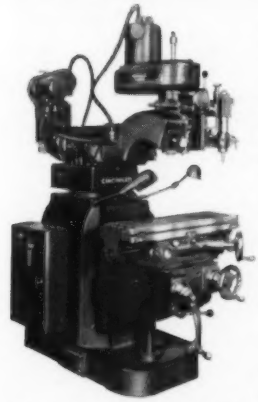
...and you may find an idea in this rubber mold setup

CINCINNATI





Milling the tread in a tire mold. The machine is a CINCINNATI 8" x 18" Tool and Die Miller, equipped with a power driven Duplex Rotary Table Attachment for completely automatic duplication of many complex shapes and intricate details with no more than casual attention from the operator.



CINCINNATI 8" x 18" Tool and Die Milling Machine. Brief specs. in Sweet's Machine Tool Catalog. Complete information in catalog No. M-1731.

Notice how the cutter spindle and tracing heads of this CINCINNATI 8"x18" Tool and Die Miller are swiveled to the most advantageous tracing and cutting position. The head can be swiveled right and left, forward and back, around a pivot approximately at the end of the cutter. Does this give you an idea? Notice the extra large cutting range evident from this setup; it's actually 8"x18" in one setting. Does this give you an idea? Notice the power driven Duplex Rotary Table Attachment; it rotates the master and work (mold) at the same speed under the cutter and tracing finger. Does this give you an idea? There are many exclusive advantages of the CINCINNATI 8"x18" Tool and Die Miller that you can translate into profitable ideas for producing plastic molds, and for contract tool and die work. Brief data on these machines will be found in Sweet's Machine Tool Catalog; complete information may be obtained by writing for catalog No. M-1731.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

the Wienermobile. Patterned after a special car used for sales promotional purposes by Oscar Mayer & Co., Chicago meat packing firm, this car resembles an oversized wiener mounted on an automobile chassis. Molded of red high-impact styrene, the Wienermobile measures approximately 10 in. long. A feature giving added play value to this model is a molded plastic silhouette of Little Oscar, the company's chef trademark character, who bobs up and down through a slot in the top of the vehicle when the car moves, actuated by a crank arm attached to the rear axle.

Wheels Molded in Tires

Illustrative of the specialization which Product Miniature has developed to expedite output of the various types of models is the unusual method of molding employed for the standard wheels used on most of the models. These wheels, $\frac{5}{8}$ in. in diameter, are equipped with black molded vinyl tires which bring their over-all diameter up to $1\frac{1}{8}$ inches. The wheel itself is made with a central hub on the inside surface, having a blind core into which the splined ends of the axles are driven in assembling the cars. Considering the vast number of wheels required daily and the labor which would be required to mount the tires individually, Product Miniature engineers worked out a system of injection molding the wheels directly into the tires, utilizing the tires as part of the mold.

This unusual operation is performed in a 20-cavity mold mounted in an 8-oz. injection machine. The mold is so designed that the operator, prior to each cycle, slips one of the tires in position on each of 20 narrow collars projecting from the cavity side of the mold. When the cellulose acetate material is injected into the mold cavities, it is confined on the front and back by the mold halves and on the outside by each elastomeric vinyl tire, causing the wheel to be formed within the tire itself for a tight, permanent fit. When the mold opens, the wheels and tires cling momentarily to the punch side of the die and are automatically ejected as the pins which core the hub section retract. The 20 complete wheels fall directly into a container and require no finishing operations.

Also of interest from the production standpoint is the method used to mount the tires on the special wheels for the Trailways bus, which are larger than the passenger car wheels and have the demountable feature described earlier. These wheels are molded so that the outside surface is flanged to retain the tire, while the opposite face of the wheel is left the same size as the inside diameter of the tire. After the tires have been slid on from the unflanged side, the wheels are placed in a specially designed rotating fixture where a spinning tapered metal head swedges the lip of the wheel outward, locking the tire permanently in place. No heat is involved in this high-speed operation, in which the tough cellulose acetate material is shaped to its final form by a method usually associated with metal working.

CREDITS: Cellulose acetate molding material by Hercules Powder Co., Inc., and Celanese Corp. of America. Zytel nylon, by E. I. du Pont de Nemours & Co., Inc. Impact styrene material (Styron 475 and 480) by The Dow Chemical Co. Automatic paint spray machines and spray masks by Conforming Matrix Corp., Toledo, Ohio. Colored finishes for cellulose acetate and styrene by Bee Chemical Co., Chicago, Ill.

DESIGN and PRODUCTION NEWS

FOR PLASTICS AND MATERIALS ENGINEERS

Published by TECHNICAL SERVICE, Chemical Manufacturing Division, The M. W. KELLOGG Company DECEMBER 1954

Insulator of KEL-F® Plastic Doubles as Vital Structural Part in Severe 250°F Water-Immersion Service

Perfect electrical insulation and maintenance of critical spacing of electrodes are provided by this spacer of KEL-F polymer plastic. Even under constant immersion in water at 250°F, insulation remains high, precision tolerances and dimensions of the spacer-insulator are maintained.

Excellent mechanical properties of this fluorocarbon plastic dielectric under extremes of temperature and stress permit the critical spacer to be used under heavy spring loading without deformation or failure. Accurately machined grooves in the plastic hold O rings to prevent liquid leakage.

McNab Incorporated, New York City, machines the spacers from rod extruded from unplasticized KEL-F polymer by the Resistoflex Corporation, Belleville, N. J. Spacers are used in special conductivity cell-valve units manufactured by the McNab company for use in marine and industrial installations producing potable water.

For further information ask for Application Report E-131

Prosthetic Eye Implants are Permanent—Non-Irritating to Living Tissue, They Retain Shape Indefinitely

Elimination of the necessity for periodic removal of prosthetic eye implants for replacement or "re-sizing" is the major advantage claimed for implants made from KEL-F polymer plastic. Once "fitted" to the individual eye socket, the implant retains its original size and shape, does not shrink or swell to cause pain to the wearer. The plastic's heat and moisture resistance allow it to be steam sterilized.

Since the fluorocarbon plastic is chemically inert, it does not cause irritation to adjacent sensitive tissues.

The plastic implant, known as the "Allen", is custom made from KEL-F polymer Grade 270 by Precision-Cosmet Co., Inc. of Minneapolis, Minn.

For further information ask for Application Report P-103

(SEE REVERSE SIDE)

® *Registered trade-mark for The M. W. Kellogg Company's fluorocarbon Polymers.*

CONTINUED FROM PRECEDING PAGE

KEL-F® Polymer Teamed With High-Alloy Steel in New Centrifugal Pump For Corrosives, Sanitary Use

A KEL-F plastic O ring is used with Type 20 stainless steel and heat-resistant glass to create a new, low-cost centrifugal pump with extreme corrosion resistance and ready flow visibility.

The KEL-F plastic seal remains resilient, is unaffected by practically all known chemical agents over a wide range of temperatures and prevents damage to the glass cover plate. Unique physical characteristics of the plastic permit ready dismantling of pump and re-use of the O ring without loss of sealing effectiveness.

The new pumps, built by the Eco Engineering Company, Newark, N. J., use precision O rings molded of plasticized KEL-F polymer Grade 300 P-25 by Young Development Laboratories, Inc., custom molders of Rocky Hill, N.J.

For further information ask for Application Report C-121

Molders & Fabricators of the Month

Leading molders, extruders and fabricators specialize in the production of materials and parts made of "Kel-F" . . . each month this column will spotlight several of these companies with their principal services and products.

Auburn Button Works, Inc.
Auburn, N. Y.
Injection molding

Bacon Industries, Inc.
Watertown, Mass.
Compression & transfer molding
Gaskets & O rings

Elco Corporation
Philadelphia, Pa.
Injection molding
Electronic tube sockets

Electronic Mechanics Inc.
Clifton, N. J.
Extrusion, injection, compression & transfer molding
Forming
Rod, tube & sheet
Coil forms & tube sockets
Diaphragms & gaskets

A. Gusmer, Inc.
Stalpic Division
Woodbridge, N. J.
Corrosion control
Dispersion application

Recent Significant KEL-F Polymer Developments . . .

Lip seals for liquid oxygen and other liquefied gas equipment operating at low temperatures are molded now of KEL-F plastic. Resiliency at sub-zero temperatures, dimensional stability and chemical inertness overcome shortcomings of other gasket and sealing materials used.

Liquid level gauges now have their glasses protected by a thin sheet of KEL-F plastic. Remaining transparent indefinitely in spite of contact with highly corrosive chemicals such as HF, the plastic sheets act as their own gaskets.

Miniature coil forms are molded of KEL-F plastic for use in electronic devices operating at elevated temperatures. Types include special models with metal inserts.

Quality test for use by the manufacturer of trifluorochloroethylene polymer parts (the "Z.S.T." test) has been developed and field-tested by Kellogg. Test is simple, requires no special training. Equipment is automatic, eliminates the human error factor in test results.

OFF THE PRESS . . .

Revised "BUYERS GUIDE" listing KEL-F polymer products, molders and fabricators.

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Plastics Sandwich

(*From pp.* 100-104)

panies such as Douglas Aircraft Co., Inc., Santa Monica, Calif., and Goodyear Aircraft Corp., Akron, Ohio, both with a basic background in the use of sandwich construction in aircraft, are now utilizing that knowledge to make available a sandwich material adaptable to many industries other than aircraft.

Boats

Sandwich constructions, by virtue of their strength, rigidity, light weight, and buoyancy, are also expected to find a major market in the design of boat hulls. To date, activity in this field has nowhere approached that of the aircraft industry, but signs point to a new expansion. Part of the reason for this expectation is the successful completion of a much-publicized 50-ft. self-propelled barge with a reinforced plastic sandwich hull.

Built by the Englander Co., Plastics Div., Baltimore, Md., for the Transport Research and Development Command of the Transportation Corps of the U. S. Army, the boat is designed to meet requirements for a flat-bottomed craft to be used on very shallow inland waterways where current Army craft have too great a draft to be of any value. The vessel weighs only 10.2 tons and can transport 5 tons of dry cargo with a draft of only 21 in. when loaded and has a maximum cargo capacity of 10 tons in deeper water. Unlike wood or steel, the plastic sandwich construction is expected to require little maintenance, and hull damage can be easily repaired without costly delays resulting from long layups in shipyard dry docks.

For the production of the hull, a special low-cost plywood mold was first built. To serve as the outer skin, layers of fibrous glass cloth, supplied by Owens-Corning Fiberglas Corp., New York, N. Y., and United Merchants, Inc., New York, N. Y., were pre-impregnated with polyester resins supplied by Celanese Corp. of America, Marco Chemical Div., Linden, N. J. When this outer skin had been laid up on the mold, the phenolic impregnated cotton duck honeycomb core, supplied by Hexcel Products Co., was placed over it. The edges of the honeycomb on both facing sides were coated with an adhesive based on Epon resins supplied by Shell Chemical Corp., Newark, N. J. Over the honeycomb, a layer of cloth impregnated with epoxy resin was next laid on and the layers of polyester-impregnated fibrous glass that formed the inner skin laid in turn on top of the epoxy-impregnated cloth to complete the sandwich.

The finished construction has five times the strength of steel, pound for pound, weighs approximately ¼ less than other conventional materials, will not rot or corrode, and requires almost no maintenance. By adding pigment to the polyester resin, almost any color can be obtained.

Englander engineers are already working on the possible adaptation of this type of construction to various types of land and sea cargo carriers. In the building trades, immediate prospects are foreseen in the fabrication of segmented Quonset huts, "I" beams, and insulation panels that would not require painting and would serve equally under tropic, temperate, or arctic weather conditions.

Depressor

Another marine application, an underwater cable depressor, owes much of its success to the adaptation of the sandwich construction technique. The depressor, which is built by Emerson & Cuming, Inc., Canton, Mass., for Airplane and Marine Instruments, Inc., Clearfield, Pa., is designed to operate a few hundred feet below the surface of the water, dragging with it a steel cable which is used to tow an underwater target simulator.

Traditionally, these depressors are made of plywood—a construction which has several disadvantages: susceptibility to minor damage in the form of chips and dents during normal handling and loss of buoyancy upon prolonged submersion. By using the sandwich construction, both problems were eliminated.

The outer skin of the depressor is a ¼ in. thick polyester-fibrous glass laminate molded over a foamed polyester resin core reinforced in turn by an aluminum inner structure. This structure, which consists of a series of parallel aluminum

tubes welded together, is suspended in a plaster mold formed from a wooden depressor pattern and the polyester is foamed around it. Layers of pre-cut cloth and mat impregnated with polyester resin, pigmented orange to permit easy identification at sea, are then laid up in a second plaster mold formed from the same wooden pattern. The core piece, roughed up for good adhesion, is inserted in this mold, additional skin layers are laid on top of it, and the entire assembly heat-cured.

The over-all specific gravity of the unit is less than one. It is designed to withstand a static pressure of 400 p.s.i. as well as towing forces of 1500 lb. minimum. Because of the smooth exterior surface of the plastic face of the depressor, there is a minimum of water friction.

In a third marine application, the deck of a new Moth-class sailboat is made by Challenger Products, North Miami, Fla., of sandwich construction, using a kraft honeycomb impregnated with phenolic resins supplied by Bakelite Co. as the core and reinforced plastics as the face.

For surface transportation applications, particularly refrigerated trailer bodies, the sandwich construction has much to offer. Thin aluminum faces with plastics foams cores or reinforced plastics faces with balsa wood or similar cores, provide insulating values equivalent to, if not better than, equal thicknesses of glass wool or hair felt between thick metal faces—and are, of course, considerably lighter in weight, increasing the payload which can be carried in the trailer.

Packaging

Re-usable containers fabricated from sandwich materials are also growing in importance. According to Skydyne, Inc., Pt. Jervis, N. Y., manufacturers who specialize in containers based on sandwich construction, industry is first becoming aware of the many advantages to be gained by using re-usable, rugged sandwich-type containers instead of wooden crates.

In addition to the economy inherent in the re-usable features of their product, Skydyne reports that their containers, which are made with faces of aluminum or reinforced plastics and with cores of Styrofoam, Strux, reinforced plastics, honeycomb, balsa, or plywood depending upon the end-use application, are also smaller, lighter in weight, and stronger than conventional packages.

An additional advantage offered by the sandwich construction is uniform quality of insulation of the core materials. In contrast to the double wall containers with fibrous glass insulation in-between which were previously used, the insulating core material of the sandwich is integral with the faces and there is no danger of loose fibers settling and destroying the efficiency of insulation.

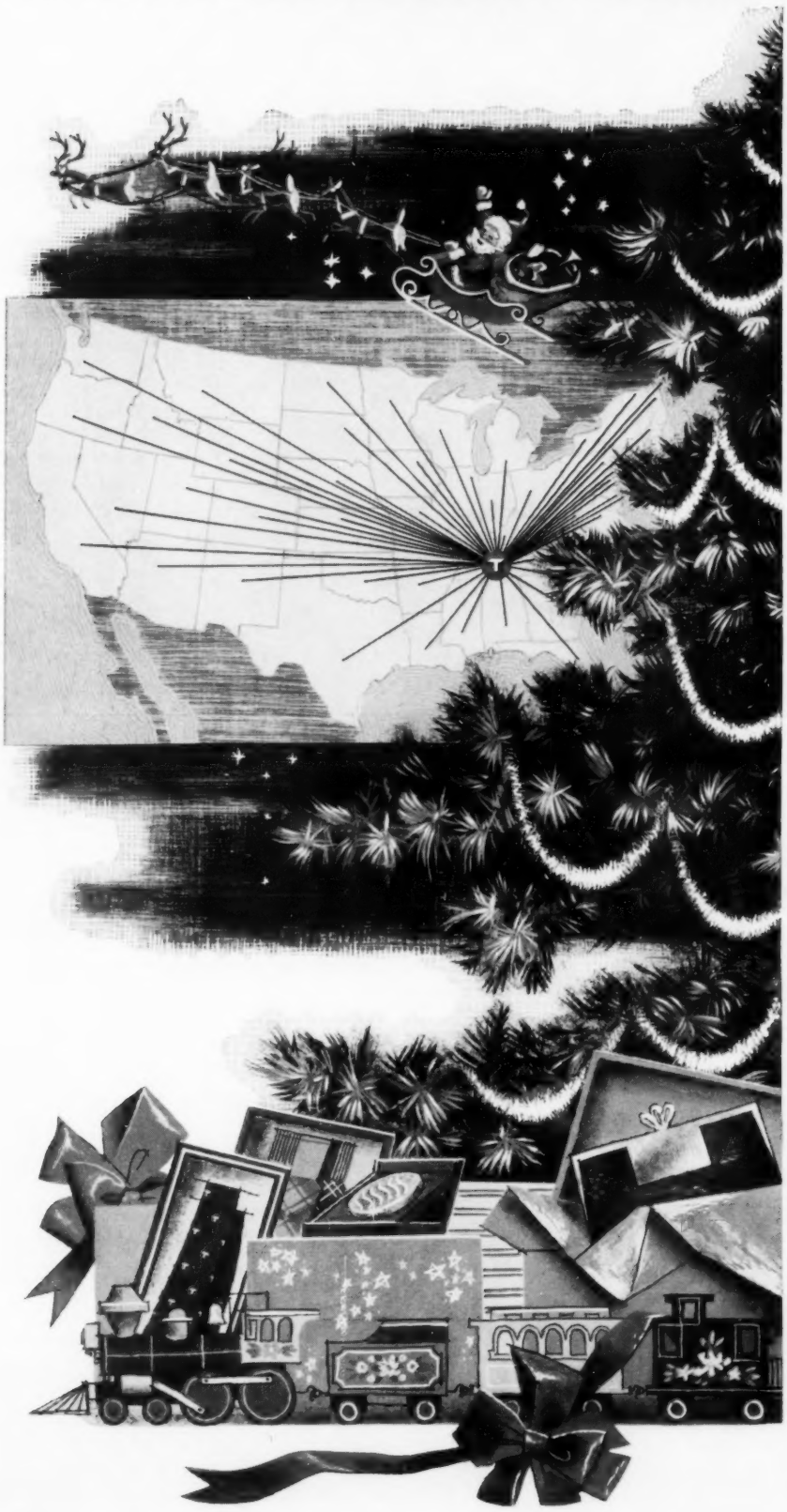
Sandwich-type containers are also used for packaging aircraft parts, precision laboratory equipment, and radio and electronic equipment.

Building Construction

Many leaders among manufacturers of sandwich materials predict that some day the building construction field will probably become the largest volume user of sandwich panels.

The material is a natural for the application. In government and military work, sandwiches already enjoy a large degree of popularity in the

THERE'S A TOUCH OF TENNESSEE IN MERRY CHRISTMAS



In Dad's necktie,
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in Junior's socks,
in Sister's compact,
in Baby's toys.

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design of portable shelters as walls, floors, or doors. E. L. Cournand & Co., Inc., Havre de Grace, Md., for example, used the sandwich construction for the floor of one of their more recent military shelter units. Phenolic impregnated paper honeycomb core and aluminum faces were combined to produce a weather resistant, rugged floor capable of withstanding extremes of temperature.

The insulation properties and light weight of sandwich materials have also played a part in the design of field-type, walk-in freezers.

In home construction, one manufacturer has already designed and produced a house of sandwich panels with aluminum-alloy faces and phenolic-impregnated paper honeycomb cores.

A great deal of work is also being done in this field by Union Bag and Paper Corp., New York, N. Y., suppliers of a paper honeycomb core impregnated with Bakelite phenolic resins. The honeycomb is sandwiched between thin aluminum sheet facings by Modern Metal Craftsmen, Inc., North Miami, Fla., to form strong, prefabricated panels to be used in the erection of resort cottages, field offices, carports, and house additions. A solid aluminum sheet as rigid as the sandwich panel would weigh ten times as much, and steel sheet up to 20 times as much. The panels can easily be joined together by means of interlocking extrusions at each side.

The honeycomb core also provides full insulation and resistance to outside temperatures at least 30% better than the ordinary frame wall with stucco outside and metal lath and plaster inside.

Honeycomb sandwich panels are made to order by the company for special construction uses.

Miscellaneous

With the successful applications described above as a stimulus, manufacturers are already applying the principles of sandwich construction to new markets. One manufacturer recently developed a field-type drawing board based on a sandwich construction which is strong and light in weight. Furniture applications in which phenolic-impregnated chip board is backed up by high pressure decorative laminates have also attracted attention. Curtain wall panels, decorative partitions, signboard, and insulating partitions for air conditioned rooms are other possibilities, as are scaffolding planks, ladders, and pallets.

From Germany come reports of several applications involving the use of polyurethane foam as the core material in a sandwich construction which conceivably may some day be big business here in this country. Included among these new applications are military pontoons, refrigerated railroad units, a lightweight passenger train in which the foam sandwiched between aluminum faces is used for walls, roofing, and floors, and beer barrels in which pressed stainless steel faces are insulated with a core of polyurethane foam.

And these applications are only a sampling of the hundreds under consideration. The availability of the new core materials, especially the plastics foams, and the development of the new synthetic adhesives which make unusual combinations of materials possible have stimulated interest . . . and since interest generates activity, the sandwich panels manufacturers can look forward to busy days ahead.—END

complex shapes molded in plastics by General American

Many manufacturers are amazed to see that complicated parts can be molded in minutes by General American. For instance, complete television cabinets, 300 per day, can be turned out on machines like this huge 3-story, 2,000 ton compression press. Count the operations eliminated!—cutting, drawing, forming, stamping, polishing, finishing, etc.

Leading appliance, automotive and aircraft manufacturers are among those using General American's big equipment and wide molding experience. Here they get lower production costs . . . one die does the work of a production line! Versatile plastics makes possible new designs, greater strength, lighter weight, beautiful colors and finish. See General American for help and ideas.

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● Facilities unmatched anywhere: injection presses to 300 ounces, compression presses to 2,000 tons, reinforced plastics molding, die making, painting, assembly, packaging

Thermosets

(*From page* 109)

blue, or cream. The small unit is conveniently styled to fit the hand comfortably and is light in weight for easy handling. A control switch is located at the rear of the housing.

The vibrator, a 6-ft. length of cord, and four types of applicators for massaging or applying cold cream, are all packaged in a smart plastics container. The base of this container is also molded of Beetle urea in powder blue with contoured depressions to accommodate the various parts of the kit. A transparent styrene cover, designed to fit closely over the base, provides protection from dust and dirt and also gives the appliance effective display appeal as a gift item.

Food Blender

The attractively styled mixing container for the food blender is molded of grey Melmac alpha-cellulose-filled melamine, has a capacity of a full quart, and is designed to contribute to the effectiveness of the blender in shredding, liquifying, or chopping foods.

Unlike more costly stainless steel containers, which are made by assembling several components, the melamine unit is molded in one piece with rounded corners and has no joints in which food particles can lodge. Odorless, tasteless, and resistant to staining, the durable container is also easy to clean. It can be cleaned by the addition of water and detergent or soap to the container and starting the mixing action, or it can be removed from the base and safely washed in an automatic dishwasher.

With the mixing container mounted securely in place on the base, the blender stands 14¾ in. high, has a base width of 4½ in., and an over-all weight of 9 lb., 13 ounces. The container itself, including blades, has a weight of only one pound.

CREDITS: Housing for knife sharpener, base of display case for vibrator, and mixing container are molded by Van Norman Molding Co., Chicago, Ill. Vibrator housing molded by Teal Molding Co., New Haven, Conn. Styrene cover for display case molded by Buckeye Molding Co., Miamisburg, Ohio. Beetle urea and Melmac melamine supplied by American Cyanamid Co.

Ceilings of Light

(*From pp.* 110-113)

Inc., and Marlux Corp., have developed special machines which form the material to shape on a continuous basis. The machine used by Luminous Ceilings consists of a series of opposing rollers through which the web of vinyl sheeting heated to forming temperature is passed. Prior to forming, however, the material is treated with a special waxing solution which reduces the electro-static attraction of the plastic and makes it easier to clean.

Details of the Marlux machine are still secret, but it is known that the unit can turn out as much as 18,000 sq. ft. of the corrugated, destaticized sheeting a day.

In the production of the individual, square- or rectangular-shaped diffusing panels, vacuum forming has developed into the most popular technique. Quantalite, for example, utilizes the process to produce panels with diamond-shaped corrugations.

Vacuum forming's major contribution to the development of the lighting system, however, is its adaptability to the production of panels with three-dimensional geometric forms and shapes other than corrugations. Daylight Ceiling Co., for example, vacuum forms its panels with such three-dimensional patterns as 8-in. square cells, concentric circles, ripples, etc. According to Daylight, these decorative shields provide the architect or lighting engineer with more flexibility in creating special lighting atmospheres or enhancing the interior design of the room.

Typical Installations

The type of buildings in which the vinyl light ceilings have already been successfully installed ranges from such mammoth structures as banks, office buildings, manufacturing plants, and department stores, down to small libraries, schools, fish markets, food stores, and even residences.

Of these applications, one of the more impressive — and widely publicized — jobs was done by Marlux Corp. in the design of vinyl ceilings for the ultra-modern Manufacturers Trust Co. bank recently erected in New York City. Architects for the bank were Skidmore, Owings & Merrill.

The corrugated panels fabricated from more than 25,000 sq. ft. of vinyl supplied by Bakelite Co. are used to illuminate the first four floors of the bank. Cold cathode fluorescent tubes are mounted 18 in. apart, 1 ft. above the plastics panels. Below the panels, aluminum plates, 10¾ in. wide and nearly 10 ft. apart, run the length of the plastic ceiling in an east-west direction concealing air-conditioning grille work.

Since the true ceiling is covered with a dark flocking to provide acoustical insulation, Marlux sprayed a white vinyl "cocoon" material over the flocking to increase its reflectance properties, and to eliminate any possibility of fibers shedding onto the plastics panels.

In another application, in which plastics light ceilings were installed in four experimental classrooms in the Franklin Elementary School in West Newton, Mass., Marlux overcame the problem of a dark structural ceiling by stapling white vinyl-coated paper to the ceiling

studs. Marlux XM, a vinyl sheet fabricated from Ultron R-310, the new formulation recently introduced by Monsanto Chemical Co., was used for the diffusing panels.

In addition to the use of the lighting system in new buildings, there has been quite a bit of activity in adapting the vinyl ceilings to remodeling buildings. Luminous Ceilings, Inc., for example, recently converted a factory space with a 14-ft. ceiling height into a pleasant modern reception room and office by simply installing the vinyl panels below the true ceiling.

Acrylic Ceilings

Many of the advantages and architectural features described above for the vinyl diffusing panels are incorporated as well in the diffusers fabricated of acrylic.

According to Rohm & Haas Co., suppliers of a cast Plexiglas acrylic sheet for the diffusing panels, the material permits the highest possible light transmission consistent with sufficient diffusion to hide the fluorescent lamps above the panels. Initial transmission values of the acrylic panels can run up to 66%, depending upon the translucency grade of the material selected, but, by painting the structural ceiling white, total light transmission as high as 90% can be obtained.

At the same time, the light is spread evenly across the surface of the acrylic with variations in brightness as low as 4% from wall to wall. In one application in which dome-shaped acrylic panels measuring 4 sq. ft. were ganged up to make the ceiling, three lamps were mounted above each panel. Each of these lamps was operated on separate controls for three levels of illumination ranging from 50 to 90 footcandles. Despite the range, however, diffusion through the acrylic was so complete that the panels were illuminated evenly at each level of light intensity.

The acrylic panels are relatively light in weight—a 4-sq. ft. panel, 0.125 in. thick, weighs only 12 lb.—and durable.

The ease of working with acrylic—it can be cut with standard fine-tooth saws—and the ease with which the material can be formed into corrugations, domes, stars, pyramids, or similar three-dimensional shapes also contribute to the

adaptability of the material to the design of luminous ceilings. If cast acrylic sheets are used, the material can be heated and shaped over inexpensive molds to accent a particular lighting effect or simply to add decorative interest to the functional values of the acrylic panels.

Recently, however, there has been a trend toward the use of extruded corrugated sheeting. By extruding the sheet through dies shaped to the desired corrugation, extra fabrication steps are eliminated and costs lowered.

An outstanding example of the adaptation of extruded corrugated acrylic panels to a luminous ceiling is the installation recently put up in the new engineering building of El Segundo Div., Douglas Aircraft Co., Inc., El Segundo, Calif. Included among the rooms in which the ceilings are installed are two 210 by 210 ft. engineering-drafting areas and thirteen private offices of varying sizes.

Using Plexiglas molding powder from Rohm & Haas Co., the corrugated acrylic sheeting was extruded by Kline Mfg. Co., Galena, Ohio, and supplied to The F. W. Wakefield Brass Co., Vermilion, Ohio, who installed the 110,000 sq. ft. of ceiling. The sheeting is 0.050 in. thick and is fabricated into panels measuring 36 by 25 inches.

According to The F. W. Wakefield Brass Co., by no other means than the broad-area translucent ceiling would it have been possible to obtain the high lighting levels desired and still, with the same expenditure of power, maintain low brightness. The fluorescent lamps mounted on 36 in. centers above the plastic ceiling provide between 50 and 60 footcandles of light intensity at the working surface. Transmission of light through the panels is 65 percent; reflectance from the white painted structural ceiling is approximately 25 percent.

To further increase the functional value of the diffusers, an anti-static solution is sprayed on the plastic to reduce its attraction to dust and acoustical baffles are suspended below the corrugated panels.

Like all acrylic diffusers, the panels used for this building can be cleaned by simply washing them with a detergent.

Plastics diffusing panels still have a long way to go in the architectural field . . . but recent improvements in materials and techniques are doing much to pave the road ahead.

The Future

Several vinyl sheet suppliers, for example, are working on new formulations that will better the light and dimensional stability of the material, as well as increase its light transmission values. Developments in the vacuum forming process have opened a completely new market for the decorative, three-dimensional sheeting in modern-day architecture and corrugating forming machines are continually being improved to increase production of the sheets to meet increased demand. At the same time, new fabrication techniques for cast acrylic sheets and developments in the extrusion of acrylic are stimulating interest in that material for the ceiling fixtures.

As one lighting engineer put it, "the future for plastics in the luminous ceiling is as bright as, if not brighter than, the light which the ceiling diffuses."—END

AMCO TOOL & DIE, Inc.
Rockville, Connecticut

REPORTS

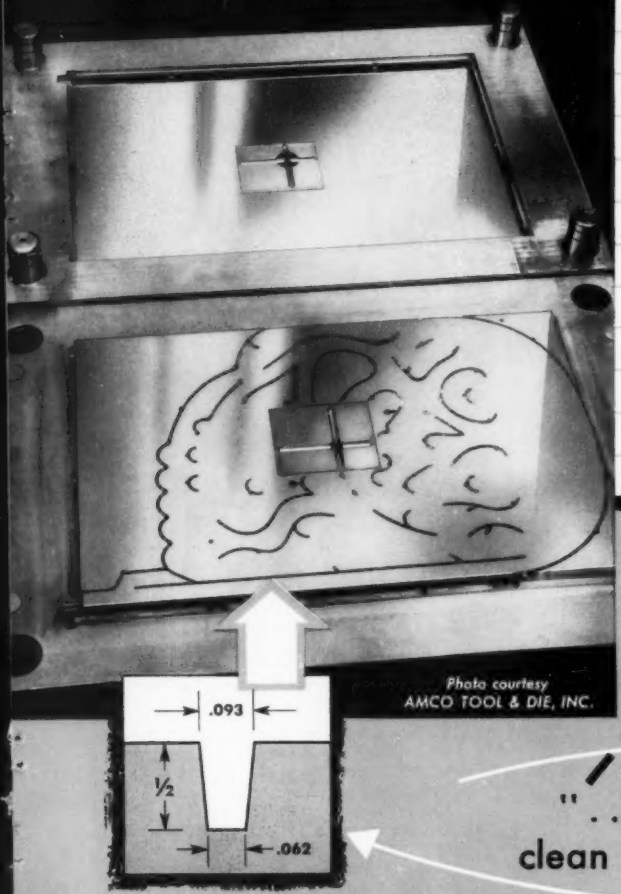

Photo courtesy
AMCO TOOL & DIE, INC.

"... milled finish on these slots are clean and free from tears when using

Cascade

pre-hardened **DIE STEEL** at
ROCKWELL C 36

"... saved bench clean-up time"

Latrobe's Cascade precipitation hardened die steel was used on the plastic mold, shown above, made by Amco Tool & Die, Inc., Rockville, Connecticut, for the Ideal Plastics Corporation, Division of Ideal Novelty & Toy Company, Hollis, New York. The prehardened Cascade had a hardness of 341 Brinell (36 Rockwell).

Cascade's superior machinability was further emphasized by the finish achieved in the slots indicated above. Slots were cut with small tapered side cutting end mills to a depth of ½", bottom width—.062". Amco Tool & Die, Inc., was outspoken in the finish achieved by the milling operation in Cascade — "... milled finish in these slots was clean and free from tears" — "... milled finish saved considerable bench clean-up time."

The clean-cutting characteristics of prehardened Cascade have been noted by many other moldmakers .. Clean cut surfaces, free from tears, will often save tedious bench time.

Uniformity of hardness throughout the cross-section of Cascade, even in large sizes, is the result of precipitation hardening — an exclusive, unique feature of Latrobe's Cascade pre-hardened die steel ... also the polishing characteristics of precipitation hardened Cascade are outstanding in the prehardened field.

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'Rough' Freight

(*From page* 114)

ventional car repair methods involve tearing out and replacing planking. Such time-consuming work, often extending over several days, requires a crew of from three to five men and costs from $75 to $125 per car. By way of contrast, the new plastic method requires only a few hours work by two men and has averaged approximately $30 each for the cars treated thus far—a figure which can probably be reduced even more in volume applications.

The new Rock Island method, developed by mechanical department officers of the railroad after witnessing "moth-balling" of Army-owned Diesel engines, is an adaptation of the procedure used by the U. S. Government to lay up battleships, aircraft, and defense plant equipment for indefinite storage.

In reconditioning a freight car, inspectors first check over the interior and chalk mark all areas needing repair, including openings worn by bolts shifting due to car movement and vibration, cracks, and splintered sections. Next, a layer of the specially formulated vinyl chloride copolymer material, gray in color and about the consistency of heavy paint, is applied over these openings with a high pressure paint spray gun. Strips of glass cloth are then cut to size and placed firmly in position on the plastic coating. A final spray coat completes the job.

The vinyl material hardens quickly to a smooth surface which resists the damaging action of scoop shovels and mechanical grain unloaders. One of the chief advantages of the new plastic method is the fact that the repaired sections remain sufficiently flexible to absorb normal twisting and weaving of the freight cars in transit, switching, etc. without harm.

Rock Island officials estimate that the economical, quickly-handled repairs may be good for several years, depending upon the use to which the cars are put. They also believe that the new system will tend to reduce loss and damage claims on grain shipments.

CREDITS: Cocoon No. 222 vinyl chloride copolymer formulated by R. M. Hollingshead Corp., Camden 2, N. J., using vinyl resins supplied by Bakelite Co. Glass cloth by Owens-Corning Fiberglas Corp.

The plastic toys shown are products of Ideal Toy Corporation. Many Ideal plastic toys are colored with Acheson Dispersions.

Uniform, Streak-Free, Low-Cost Colors for Molded Plastic Products

ADP concentrated color dispersions, thoroughly dispersed in polystyrene and polyethylene, give you bright, sales-appealing products with smooth, streak-free coloring that runs uniform from batch to batch. No dusting, no color wasted as filler . . . as with dry pigments. In ADP Dispersions the colors are completely developed so that you get the exact shade you want *every time*, and at lower cost.

ADP color dispersions are available as dry granulations in precise degrees of fineness or coarseness to match the fineness of your clear resin granulations.

Send for samples to meet specified requirements. Or perhaps you have a problem in coloring! Whatever your problem . . . let us help! You can share our experience of nearly a half-century in dispersing techniques.

Acheson Dispersed Pigments Co.
2252 E. Ontario St., Philadelphia 34, Pa.
. . . also Acheson Colloids Limited, Slough, England

Phenolic Projector

(*From page* 115)

the hollow interior of the handle. The main housing itself is ventilated by a series of stepped louvers molded into the neck of the unit which surrounds the light bulb.

Before fastening the two halves of the main housing together, the glass mirror is slipped into a special seat molded into the inside of the housing and the metal foil reflector is secured in place by fitting two small lugs molded into the walls of the housing into two holes in the metal foil. Two slots molded into the neck of the housing directly above the louvers are designed to accommodate the rim of the phenolic socket holder.

When all the parts are in place, the two halves of the main housing are easily assembled by screwing five tubular threaded fasteners into five molded-in holes.

The other phenolic parts of the projector—the socket holder and the lens barrel—are compression molded in a 150-ton press. Three complete socket holders and lens barrels are molded in one shot.

The lens barrel is molded in two halves. Each half is then cemented in place to a cardboard tube which in turn holds the two magnifying lenses at either end of the barrel in proper alignment. A rim molded into the ends of the barrel keeps the lenses from falling out. The assembled lens barrel fits into an opening provided for it in the front of the projector and slides in and out for focusing in the conventional manner.

By designing the two molds so that the housing halves, the lens barrel halves, and the socket holder can each be molded in one piece, the costs of manufacturing and assembly have been considerably reduced. As a result, the Magnajector opaque projector can be retailed at $5.95—a price which, coupled with the attractive appearance of the unit and the simplicity of its operation, has helped develop an enthusiastic reception to the product from children and adults alike.

CREDITS: The Magnajector projector is molded for Peter-Austin Mfg. Co., Toronto, Canada, by Maple Leaf Plastics Co., Toronto, using general-purpose phenolic supplied by Bakelite Co. The projector was designed and engineered by Sid Bersudsky & Associates, Toronto, Canada.

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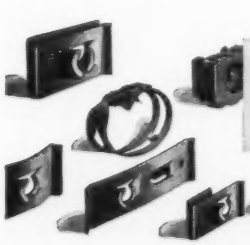

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PLASTISOL COLORANTS. Chart lists a wide selection of colors, both organic and inorganic, available to formulators and users of plastisol compounds. Also describes "Stan-Tone" cadmium paste colors designed to be completely compatible with polyester resins. Harwick Standard Chemical Company. (L-402)

HAND OPERATED INJECTION PRESS. Data on "Plasticor" quarter-ounce capacity injection press, suitable for experimental short runs, color testing, small precision parts, novelty items, optical and dental parts, and a multitude of other small molding operations. Unit operates up to 225 cycles per hour on 100-125 pounds p.s.i line pressure. Simplomatic Manufacturing Company. (L-403)

PLASTICS SCRAP GRINDER. Folder on the profitable grinding of plastics sprues, gates, warm-up shots, and rejects into homogeneous granules for uniform mold flow using the American Rotary Knife Chopper. American Pulverizer Co. (L-404)

"PLEXIGLAS" SHEETS. New literature gives complete story on "Plexiglas" sheets for use in lighting, store fronts, signs and glazing. Chart gives physical properties in terms of mechanical, electrical, thermal, optical and chemical values. Also explains and illustrates a wide variety of uses. Rohm & Haas Company. (L-405)

AUTOMATIC INJECTION MOLDING. Brochure covers new 4-ounce injection molding machine giving positive ejection and producing finished, degated pieces. Specifications, details of construction and operation, and production economies are presented. F. J. Stokes Machine Co. (L-406)

"ENTOLETER" IMPACT MILL. Bulletin describes special mill designed for centrifugal mixing, or particle size reduction, of materials through impact. Design features which include greater capacity per HP, simplified maintenance, a positive timing belt drive, and compact installation are also detailed. Entoleter Div., The Safety Car Heating and Lighting Co. Inc. (L-407)

"PLASTICS NEWSFRONT." Recent issue of this house organ is devoted mainly to applications of "Melmac" Resin 405 as used in laminates for cabinet work, office furniture, and kitchen and bath. Also illustrates applications for other "Melmac" and "Laminac" resins. American Cyanamid Company. (L-408)

EXTRUDER. Bulletin describes extruder developed for handling soft and hard PVC, polyethylene, cellulose acetate, polystyrene, polyamide, and other thermoplastic materials. Also describes special extruder heads used in the production of tubes, covered cables and wire, sheet and film. A. Reifenhauser. (L-409)

TEMPERATURE CONTROL MANUAL. Technical handbook describes new and improved concepts of temperature control for the plastics industry. Diagrams and text analyze several systems of mold temperature control in detail. Methods of quench and curing tank control techniques are also discussed. The Powers Regulator Company. (L-410)

PRESSURE SWITCHES. Electrical rating chart, specification data, and special features of the "Meletron" line of pressure and vacuum-actuated switches for use in hydraulic systems are contained in a booklet issued by Barksdale Valves. (L-411)

HYDRAULIC LABORATORY PRESS. Information on "Eemco" 42-ton hydraulic press suitable for both production and experimental research in compression molding of plastics, laminating and pressing vinyl sheets. Erie Engine & Mfg. Co. (L-412)

DIE STEEL FOR PLASTICS MOLDS. Brochure describes uses and properties of precipitation hardening pre-hardened steels which can be readily nitrided using conventional gas nitriding equipment. Latrobe Steel Co. (L-413)

PLASTICS GRANULATING MACHINES. Catalog with technical data on twelve Cumberland granulators, Lists their capacities, adjustments, and diversified uses. Cumberland Engineering Co. (L-414)

STAMPING NAME PLATES. Data on the methods and equipment which are used to stamp etched metal name plates with numbers and other types of identification. The Acromark Company. (L-415)

GLASS FOR REINFORCING AND SURFACING. Folder illustrates and describes glass reinforcing, surfacing, and industrial mat, glass tapes, veil and "Puffglass" manufactured by Modigliani Glass Fibres, Inc. (L-416)

PLASTICS PIPE. Description of the advantages and economies derived by using "Walpipe" made of cellulose acetate butyrate or polyethylene. Data on applications for flexible and rigid plastics pipe. Waljohn Plastics, Inc. (L-417)

AUTOMATIC REGULATORS. Bulletin shows a collection of eleven automatic regulators, valves, and governors suitable for use in controlling flow of pressure and steam, gas, air and water systems. Atlas Valve Company. (L-418)

VACUUM FORMING MACHINES. Folder gives information and specifications on a fully automatic unit for producing a wide range of products by the vacuum forming of various thermoplastic sheet materials. Vacuum Forming Corp. (L-419)

COMPRESSION MOLDING PRESS. Brochure describes new press engineered and built to speed up and simplify compression molding of plastics. Explains how each press is engineered for a particular job, then built of standard parts to provide a "custom" unit at low cost. The Lodge & Shipley Company. (L-420)

"DUAL CAST" MOLDS. Folder describes process of casting a combination of nonshrink aluminum base alloys into unbreakable shell molds that require no reinforcement. Illustrates various molds for vacuum and drape forming, molding expandable polystyrene, reinforced plastics, and blow molding of polyethylene. Victory Mold and Die Company. (L-421)

VINYL SHEET CONVERTING. Reprint of article appearing in MODERN PLASTICS describes how this manufacturer of heat-sealing equipment has engineered and installed complete plant set-ups for vinyl film converters. Mayflower Electronic Devices. (L-422)

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COLORING POLYSTYRENE. Folder investigates problems involved in coloring large granules of polystyrene during the extrusion process. Explains the types of colors that can be used satisfactorily, equipment required, handling of mottled colors, getting varying shades of color, and what to do with scrap polystyrene. Ferro Corp. **(L-423)**

CHUNK CUTTER. Data on equipment for convenient and low cost salvage of large slugs and chunks of scrap plastics by reducing them to granules. Literature gives complete details and specifications of the machine which handles over 150 pounds per hour and permits quick, easy cleaning. The DeMattia Machine and Tool Company. **(L-424)**

REINFORCED PLASTICS. Literature details company's facilities for fabricating and assembling products of glass reinforced plastics. Describes, and gives specifications of reinforced items such as tubs, tubing and high-pressure storage bottles for liquids and gases. Fibre-Glass Division, The Apex Electrical Manufacturing Company. **(L-425)**

FAR-INFRARED HEATERS. Folder explains how high efficiency, far-infrared heaters are used to provide uniform heat for softening, curing, drying, and otherwise processing plastics resins and materials. Edwin L. Wiegand Company. **(L-426)**

STRAIN INSPECTING POLARISCOPE. Handbook describes and gives operating procedures of Pioneer Model No. 60 Polariscope for use in determining strains in plastics materials. Discusses analysis, by polarization, of styrene, vinyls, polyethylene and acetate. Pioneer Scientific Corp. **(L-427)**

"MARVINOL" VINYL RESINS. Brochure on compounding and processing "Marvinol" resins discusses compounding plasticizers, stabilizers, lubricants, colorants and fillers. Gives details on calendering, extrusion, injection molding, slush molding and other production methods. Naugatuck Chemical Division of U. S. Rubber Company. **(L-428)**

REINFORED PLASTICS. Details on three types of Erico reinforced plastics materials compounded and used by this custom molder to meet a variety of requirements. Chart gives complete physical properties of all three, covering water absorption, heat resistance, flame resistance and various strengths and hardnesses. Erico Products, Inc. **(L-429)**

COMPOUNDER-EXTRUDER EQUIPMENT. Bulletin tells how different double-worm combinations and barrel lengths make possible a wide variety of compounding and processing operations. Describes such specialized uses as scrap reclamation, coloring, extraction of volatiles, and the compounding of different thermoplastic materials and synthetic rubber. Welding Engineers, Inc. **(L-430)**

VALVES FOR INFLATABLES. Booklet describes 22 different clamp-on, seal-on and insertion type valves for use with inflatable plastics products. Includes mouth and pump operated types. Halkey-Roberts Corp. **(L-431)**

INJECTION MOLDING MACHINES. Folder covers the complete line of Reed-Prentice injection molding machines. Includes details and specifications on five models with production capacities, ranging from 4 to 48 ounce. Reed-Prentice Corp. **(L-432)**

REPLACEMENT HEATING CYLINDER. Leaflet covers special heating cylinder developed to speed up molding cycles on injection presses, end plunger stalling, provide uniform performance. Also describes how simple design cuts degrading, burning, fish scales because lower heats are used. Injection Molders Supply Co. **(L-433)**

DRY COLOR BLENDING. Information table on "Atlas" dry colorants for dry blending with polystyrene. Gives color breakdowns, prices, weights. H. Kohnstamm & Co. **(L-434)**

HYDRAULIC PRESS. Catalog describes 60-ton ram pressure press with 18" x 18" platen, especially adaptable to the manufacture of laminates where pressure and control are primary factors. Constructed to minimize platen deflection. Pasadena Hydraulics. **(L-435)**

FINISHING AND POLISHING OF PLASTICS. Booklet relates the methods and materials needed to finish and polish thermoplastic and thermosetting plastic moldings in tumbling barrels. Lacrinoid Products Ltd. **(L-436)**

"PLASTOLEIN" PLASTICIZERS. Handbook describes seven plasticizers, giving specifications, physical and chemical properties, performance data and suggested uses. Other sections cover test procedures, preparation of test samples, and various data on specific gravity, viscosity, and stabilizer. Emery Industries. **(L-437)**

HORIZONTAL INJECTION MOLDING PRESS. Facts on new, low cost, automatic Van Dorn 2¾-ounce horizontal plastic injection molding press. Data includes price, performance details, specifications and advantages. The Van Dorn Iron Works Company. **(L-438)**

INDUSTRIAL PLASTICS EQUIPMENT. Brochure illustrates and details 17 machines for use in plastics production. Included are mixers, sheeting mills, presses, both compression and transfer, and calenders. Lists individual specifications and applications. Stewart Bolling and Co. **(L-439)**

TEMPERATURE CONTROLLER. Brochure describes first indicating temperature controller to utilize a thermistor as the sensing element. Tells how the controller's design achieves selective control, mechanical and electrical stability, and simplicity of operation and maintenance. Fenwal Inc. **(L-440)**

FIRE RESISTANT POLYESTER RESINS. Technical data sheet lists specifications and properties of "Hetron 92" polyester resin. Hooker Electrochemical Co. **(L-441)**

WEATHER TESTING DEVICE. Comprehensive look at the "Weather-Ometer," a laboratory apparatus for ascertaining, at a greatly accelerated speed, a trend of reactions which will occur in a product upon subjection to outdoor exposure, sunlight, moisture and temperature changes. Atlas Electric Devices Company. **(L-442)**

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Reinforced Sheet

(*From pp.* 121-125)

precut sheets of the approximate size and shape, minimizing additional operations in the fabricator's plant. On parts requiring differential wall sections in certain locations, additional thickness at corners, etc., additional strips of the material may be superimposed.

Cost

The introductory cost of Scotchply reinforced plastic, based on epoxy resin, is $2 per lb. in quantities from 1 to 499 lb.; $1.95 per lb. for quantities from 500 to 1999 lb.; and $1.90 per lb. for orders exceeding 2000 pounds. 3M officials point out that these prices apply to sheets having maximum physical properties, for products requiring the utmost in strength characteristics. For less critical applications, the material may be tailored to a lower cost through addition of extenders or fillers, without drastically altering the strength and uniformity characteristics which are obtained through the unique linear arrangement of the glass reinforcement.

In evaluating the new material, 3M officials point out, molders should think in terms of total part cost and "built in" properties made possible through use of the Scotchply sheet. Elimination of the customary preforming and resin saturating of the glass fiber reinforcement saves plant time and labor prior to the actual molding operation and permits employees to concentrate on actual production of finished parts. Preparation of the sheet under closely controlled manufacturing conditions results in a degree of uniformity very difficult to achieve when working with preforms and hand layups in the molding plant. And the availability of inherent color, woodgrains, Scotchlite, and other decorative or functional surface effects in the uncured sheet means the total elimination of decorative finishing operations for many products.

CREDITS: Glass fiber reinforcement used in Scotchply is supplied by Owens-Corning Fiberglas Corp., and Libbey-Owens-Ford Glass Co. (Fiber-Glass Div.). Resin suppliers: Bakelite Co., a Div. of Union Carbide and Carbon Corp.; Shell Chemical Corp.; Hooker Electrochemical Co.; Celanese Corp. of America; and Ciba Co., Inc., Plastics Div.

Balanced Gating

(*From pp.* 134-135)

corresponding equations set up based on runner length and gate land.

To complete the calculations, the initial gate size is selected as representing gate No. 2. Since runner length to gate No. 4, 4A, 2, and 2A is identical, and a constant land was selected, the gate size of 0.027 in. deep by 0.081 in. wide by 0.050 land holds for each of these gates. Likewise, gates No. 1 and 1A will have a particular size and gates No. 3, 3A, 5, and 5A will be alike.

In the over-all design there will be three different gate sizes representing 10 cavities. Cavity weights are to be equal and consequently the balanced gate values will be equal.

The size and area of gate No. 2 has been computed to be 0.0022 in.^{2}; formula substitution gives:

No. 2 Gate area = 0.0022 in.^{2}
No. 2 Runner length sprue to cavity = 7¾ in.
Gate land = 0.050 in.
No. 1 Gate area = Unknown A_1
No. 1 Runner length sprue to cavity = 2 in.
No. 1 Gate land = 0.050 in.
No. 3 Gate area = Unknown A_3
No. 3 Runner length sprue to cavity = 13½ in.
No. 3 Gate land = 0.050 in.

$$\frac{0.0022}{7\frac{3}{4}^{1/3} \times 0.050} = \frac{A_1}{2^{1/3} \times 0.050}$$

$$= \frac{A_3}{13\frac{1}{2}^{1/3} \times 0.050}$$

Solving the formula for A_1 and A_3

$A_1 = 0.0011$ in.^{2}
$A_3 = 0.0028$ in.^{2}

Based on the 3 to 1 width and depth relationship of gates:

$A_1 = 0.0011$ in.^{2}
Gate No. 2 Size = 0.058 by 0.019 in.
$A_3 = 0.0028$ in.^{2}
Gate No. 3 Size = 0.090 by 0.031 in.

The complete mold design gate dimensions are then listed as 0.050 in. land and width and depth as follows:

No. 1—0.058 by 0.019 in.
No. 1A—0.058 by 0.019 in.
No. 2—0.081 by 0.027 in.
No. 2A—0.081 by 0.027 in.
No. 3—0.090 by 0.031 in.
No. 3A—0.090 by 0.031 in.
No. 4—0.081 by 0.027 in.
No. 4A—0.081 by 0.027 in.
No. 5—0.090 by 0.031 in.
No. 5A—0.090 by 0.031 in.

In the use of the formula, various conditions can be accounted for. In long runner systems (12 to 15 in. from sprue) it is often wise to reduce gate land by 0.005 in. every 5- to 8-in. increment away from the sprue. This overcomes any wide gate variation in long runner systems. The use of the formula makes it possible to cut all gate sizes equal with respect to length and width, and obtain balanced gating by merely varying gate land. Unequal cavity weight can also be taken into account in the formula by letting the gate values represent the weight relationships of the cavities.

In the case of multi-gated single cavities, the molder must first locate on the part print where he wants his weld lines to fall. He then must calculate the weight of plastic in each section and let this weight represent the balanced gate value in the equations. Here also the runner size and initial gate size must be selected and all other gate sizes calculated on a basis of unequal runner length and/or gate land.—End

Metal-Bonding

(*From pp.* 139-147)

of FPL-710 adhesive by variations in bonding procedures and variations in formulations have not yet been entirely successful. A significant improvement in peel resistance was obtained only when synthetic rubber was included in the formulation. When the rubber was incorporated in solution form, however, the adhesive mixture usually became incompatible in solution, and appreciable bond strength was lost at elevated temperatures. One experimental adhesive composed of phenol resin (200 parts Bakelite BV 9700), epoxy resin (15 parts Epon 1001), and buna N rubber (50 parts Hycar OR-15) was considered a promising formulation because of its compatibility and generally good strength properties at elevated temperatures. This adhesive was prepared by milling the components together on a rubber mill with considerable difficulty. This technique resulted in satisfactory compatibility in solution in methyl ethyl ketone and in strength at elevated temperatures, but no apparent increase in peel resistance over FPL-710. Further study of adhesive formulations of this type employing greater amounts of rubber and prepared by a milling process should be considered as a possible approach in future undertakings aimed at improving the peel resistance of adhesive formulations.

Sandwich Construction

Recently, in a few limited tests, the use of FPL-710 mat-type adhesive to bond metal faces to heat-resistant honeycomb cores for a sandwich was particularly promising. The use of impregnated mat permitted the addition of sufficient adhesive to the face of the sandwich to form fillets on the edges of the honeycomb core, and also appeared to increase the resistance of the faces to peeling. In a few individual shear tests of steel plates to phenol-resin-impregnated glass-cloth honeycomb core (7) a strength of 320 p.s.i. was obtained at 400° F. and 160 p.s.i. at 600° F.

References:

1. Black, J. M., and Blomquist, R. F., "Development of Metal-Bonding Adhesive FPL-710 With Improved Heat-Resistant Properties," NACA RM 52F19 (1952).

2. "Adhesive, Metal to Metal, Structural," Spec. No. 14164, U. S. Air Force (Sept. 20, 1949).

3. Watson, R. W., and Tom, T. B., "Relation of Structure and Effectiveness in Cooper Deactivators," Industrial Eng. Chem. *41*, 918-923 (May 1949).

4. DeCroes, G. C., and Tamblyn, J. W., "Protection of Cellulose Esters Against Breakdown by Heat and Light," Modern Plastics 29, 127-128, 130, 132, 134, 136, 185-189 (Apr. 1952).

5. Soloway, S., and Rosen, P., "Differentiation of Chelating From Nonchelating Phenols," Analytical Chem. 25, 595-598 (Apr. 1953).

6. Martell, A. E., and Calvin, M., "Chemistry of the Metal Chelate Compounds." Prentice-Hall, Inc., 1952.

7. "Methods for Conducting Mechanical Tests of Sandwich Construction at Normal Temperatures," Forest Products Lab., Rep. No. 1556, revised 1948.—End

Time-Temperature

(*From pp.* 148-151)

plots indicated that the creep curves of the plastics under tensile stresses were similar in shape to the rupture curves. The compressive creep data were too sketchy; consequently, no conclusions of an acceptable degree of validity can be reached regarding them.

It is probable that the relationship would hold for any material or bonded assembly subject to failure by creep. Besides metals and plastics, elastomers and inorganic crystalline and non-crystalline materials could also be included in this same classification.

Summary

In conclusion it may be stated that the time-temperature relation expressed by the parameter:

$$T(20+\log t)$$

may be applied to tensile and compressive rupture data on laminates fabricated from polyester resins reinforced with glass fibers with the following results:

1. Application of this relation allows the use of short-time tests at elevated temperatures to determine long-time data which may be expected to apply at room-temperature conditions.

2. The degree of accuracy is not known because no long-time data are at present available as a check on the results.

3. Long-time rupture data obtained by extrapolation of time-stress curves agree in most cases with data obtained by use of the parameter above, which expresses the time-temperature relation.

References

(1) "Elevated Temperature Properties of Glass Fabric Base Plastic Laminates," USAF Technical Report No. 6172, Battelle Memorial Institute, May 31, 1950.

(2) J. H. Holloman and L. C. Jaffe, "Time-Temperature Relations in Tempering Steel," Transactions A.I.M.E., Iron and Steel Div., *162*, 223-249 (1945).

(3) F. R. Larson and James Miller, "A Time-Temperature Relationship for Rupture and Creep Stresses," Transactions A.S.M.E. *75*, 765-775 (July 1952).—END

Dielectric Strength

(*From pp.* 152-158)

having the highest breakdown voltages perpendicular to laminations and Grade N-1, the highest parallel to laminations.

Safety Factor

For dry specimens, the endurance limits (in either direction) of the seven standard grades of laminates tested vary from 49 to 84% of the corresponding short-time dielectric strength. Therefore, the designer can consider a safety factor of 3, based on the short-time test, to be sufficient. For Grades XX and XXXP exposed to high humidity and elevated temperatures (Parts B and C of Table IV), the percentage ratio of endurance limit to short-time dielectric strength ranges from 47 to 86% (including both directions). Again, a safety factor of 3 should be satisfactory. In actual practice, a designer may expect to use equipment under highly humid conditions, yet available data on the laminates may be limited to short-time dielectric strength under dry conditions. In these cases, a safety factor of 6, as recommended by N.E.M.A.,[3] may be necessary.

Conclusions

These tests indicate that for selecting thermosetting plastic laminates to be used as a dielectric medium, it is important to know the temperature at which the equipment is to be operated, the atmospheric conditions to be encountered, and the mechanical strain and the dielectric stress to be applied. If the equipment is used under dry conditions and the mechanical strength requirements are not severe, paper-base laminates are very satisfactory. If humid conditions are factors, it would be advisable to use the more water-resistant paper-base grades such as Grade XXXP. Under dry conditions requiring high mechanical strength it may be necessary to use a fabric grade such as LE, and under continuous humid conditions requiring high mechanical strength it may be necessary to use Grade N-1. If arc resistance is an important requirement, Grade G-5 laminate appears to be indicated.—END

[3] N.E.M.A. Standards for Laminated Thermosetting Products Publication No. 46-118, August, 1946, paragraph LP-64.

THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Acrylics, Acrylates, and Methacrylates

NOMENCLATURE in the chemical and plastics industry is often considered to be peculiar, to say the least. Maybe the chemists love it, but it's a pain in the neck to those laymen who know little about formulations yet have to handle the materials. Many words sound like gibberish to such laymen, even though they may have a smattering of chemical knowledge.

One of the most confusing of all the mixups in plastics materials nomenclature is the acrylic and acrylate situation. Anyone who reads this column knows that Orlon fabric is as different from Plexiglas or Lucite plastic as is cotton from copper. However, in common parlance, they are both called acrylics. How come that a piece of so-called acrylic fabric for a window drape can have the same generic name as a piece of hard, transparent acrylic plastic that might even be used for the window pane? This transparent material may be known by the tradenames Plexiglas or Lucite, but in plastics parlance it is often called one of three different names, viz.: acrylic, acrylate, or methacrylate.

According to the chemists, both the Orlon fabric and the hard plastic mentioned above may be properly called acrylics. But such simple nomenclature won't end the confusion because many of the acrylic monomers are called acrylates; methyl acrylate, for example, is an acrylic monomer but is listed as an acrylate in the plastics trade.

Unsimple Complexity—An attempt to simplify this unsimple complexity in lay terms is difficult and may be widely misunderstood. However, because of the present confusion and also because of the important developments now going on in this field, the following attempt is made to at least partially explain such differences as exist between acrylics and acrylates. Frequently, they are the same.

Acrylic describes a general class which includes acrylates and methacrylates. But in this acrylic class, there are other materials that are neither acrylate nor methacrylate—acrylonitrile is an example.

In the methacrylate group are the methyl methacrylate plastics, Plexiglas and Lucite, or "acrylate" plastics.

In addition, methacrylate monomer is thought to be used for methyl methacrylate latex which is now facing a promising future as a paint resin. Rohm & Haas, the producer, will not identify the resin used except to classify it as an acrylic. Still other products obtained when the methyl methacrylate latex is modified with ethyl or methyl acrylate or some other undisclosed materials, are finishing compounds for leather —substances that make leather crack resistant and give it a high gloss. These are, more or less, lacquers that produce flexible films.

When octyl, dodecyl, or cetyl alcohol is substituted for methyl alcohol in preparation of the above methacrylate monomer, the polymer producer comes up with a product used in oil and hydraulic fluids. It is a viscosity index improver and a pour-point depressant; that is, it makes lubricants easy to pour at low temperature. Therefore, it keeps oil or hydraulic fluid at approximately the same thickness or viscosity even when subjected to extremes of temperatures, as in airplanes which may fly at both low and high altitudes within a short period of time. In automobiles with fluid drive, this type of methacrylate prevents the fluids from becoming too thick in winter and too thin in summer.

Sharp Distinction Difficult—In general, the above paragraphs cover the best known methacrylate products, but a sharp distinction from the acrylates is difficult to make. The situation is not like leaving one room to enter another, but more like removing the wall between them; a certain amount of mixture takes place since the methacrylate group is frequently modified with acrylates. And either or both, as well as the modified materials, may be called acrylics!

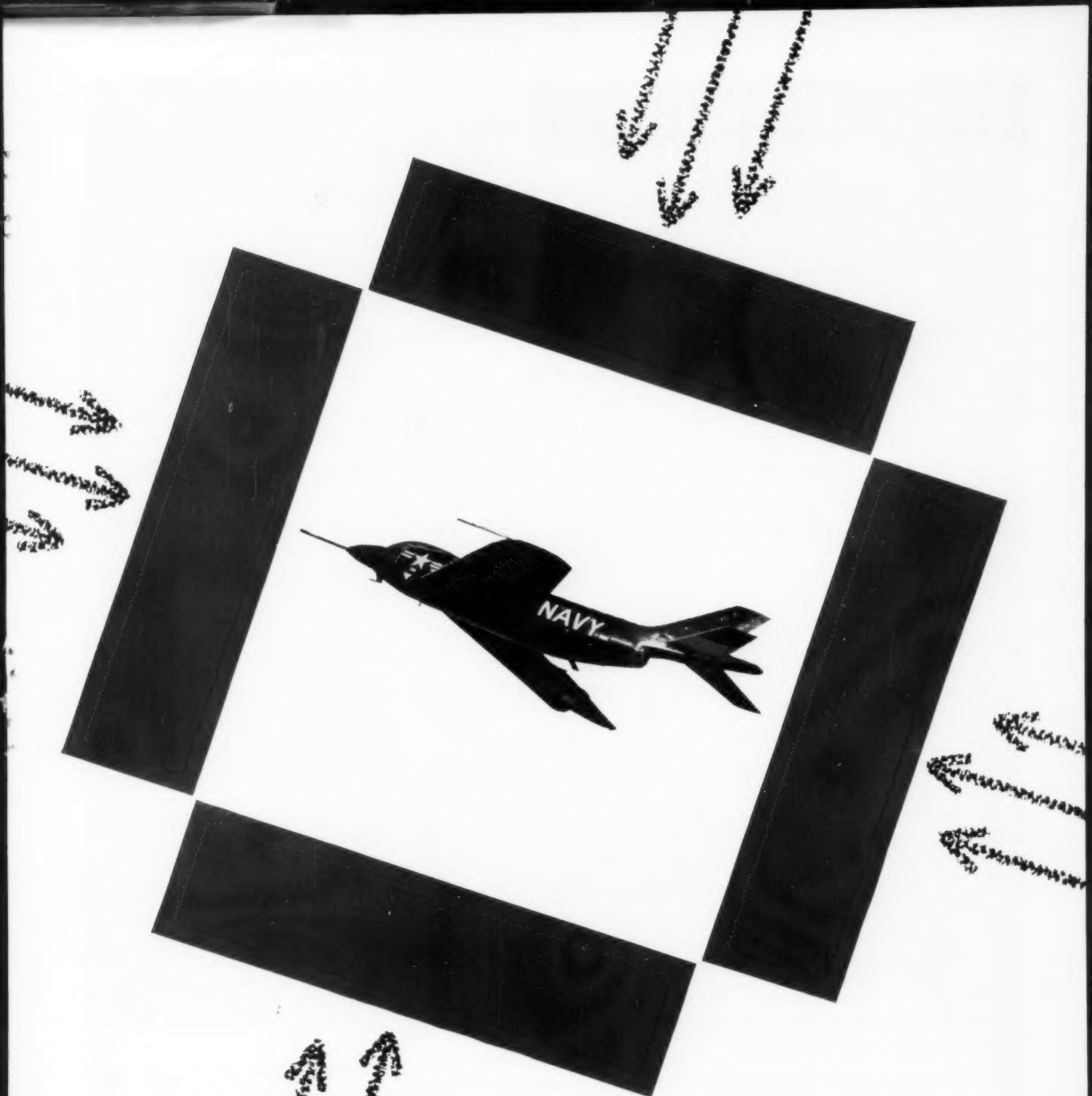
In the acrylate portion of the acrylics group, the best known monomers are methyl and ethyl acrylate from which polymers can be made, either alone or in combination with other monomers. Another monomer in this group is ethylhexyl acrylate just recently announced as in production by Carbide and Carbon.

The acrylate polymers are generally soft and rubbery, in contrast to the hard and horny methacrylates. They have other outstanding properties such as flexibility, stability to heat and light, and unusual resistance to aging. A commercial example is Goodrich Chemical's acrylate-type rubber, which is notable for its heat resistance. Acrylate rubber should not be confused with Hycar (acrylonitrile-butadiene rubber), which is an acrylic rubber. Confusing, eh? But the reason Hycar is an acrylic rubber is that it is one of those members of the acrylic family which does *not* contain an acrylate . . . so there are both an *acrylate* and an *acrylic* rubber.

The acrylate polymers are noted for their "stretchiness." They are useful in such things as chewing gum and paint, and to impart flexibility to the product when copolymers are made with other monomers such as vinyl chloride, vinylidene chloride, styrene, and even methyl methacrylate. With vinyl chloride, an acrylate monomer of one type may result in a resin that requires no plasticizer and would produce a film of extreme clarity. For a long time it has been suspected that a vinyl-chloride-acrylate copolymer resin would soon be introduced to the trade. Indeed, there may even be such resins on the market now, but still unidentified to formulation.

Mixed With Dirt—Other variations in this acrylate division of the acrylic family are found in the alkali formulations wherein a material such as sodium, potassium, or ammonia is used with acrylic acid. Two of the well-known alkali-type polyacrylates are sodium polyacrylate (used as a soil conditioner) and cal-

*Reg. U. S. Pat. Off.



SWEDLON Armor protects the pilot in the McDonnell F3H

The F3H Demon, carrier-based jet fighter being produced by the McDonnell Aircraft Co. of St. Louis, Mo., now embodies another feature that contributes to the safety of the pilot in combat.

The all-important human factor, the pilot, is now protected at the most vulnerable points of the cockpit by Swedlow Laminate XIG–112, approved under MIL. Spec. A-17856 (Aer) Armor fragm. non-metallic—on the floor, as protection against flak—in the backrest, as protection from bullets—and as protection for the vital electronic controls.

For information on this and other Swedlow laminate applications, contact the Swedlow plant nearest to you.

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cium acrylate (used as a soil stabilizer). The former makes soil more friable, the latter hardens the surface and has been tried with some success on military airfields and roads.

Acrylonitrile is the principal member of the acrylic family that *cannot* be called an acrylate or methacrylate; it is technically vinyl cyanide.

The first butadiene-type synthetic rubber made in the United States was the acrylonitrile-butadiene type like Goodrich's Hycar. However, it is generally called nitrile rather than acrylic rubber and, as noted above, is considerably different from acrylate rubber which is derived from the ethyl acrylate-type of acrylic. A growing use for acrylonitrile is in Orlon and Acrilan fibers used in the textile industry. It is also used in Dynel, a vinyl-acrylic type fiber. All these fibers are noted for their warm, wool-like structure and crease retention.

A further illustration of the possibilities for confusion in this strange acrylic family can be had by comparing sodium polyacrylate, the soil conditioner, and Orlon, the fabric. Both are derived from acrylonitrile. The soil conditioner is made from polyacrylonitrile by reacting it with caustic soda and water. If anyone wanted to make a soil conditioner out of Orlon window drapes, all he would have to do is hydrolize them. It's not a recommended task for the average gardener, but in theory it is possible.

Full Potentials Hidden—It is easy to understand that the acrylic family is vast and complex, that it involves many kinds of raw materials, and that it enters into a diverse line of products. It is easy to foresee that the acrylics are destined to make more people more conscious of the plastics industry. But at this stage of the game, it is mighty difficult for the layman who has to work with them to understand their full potentialities or to distinguish one from another.

Probably the most outstanding property of acrylic monomers is the ease with which they can be combined with other monomers to produce better properties than are attained in the straight polymers. Whenever the word acrylate or acrylic is used in announcements of new or improved plastics, processors would be well advised to take a good look.

The particular products likely to be most affected by developments in acrylics are vinyls, adhesives, oil additives, emulsion paints, and surface coatings such as those used in the manufacture of plastics upholstery and leather treatments.

In conclusion, it is to be hoped that the chemical industry may be moved to clear up the confusion in nomenclature in this highly complex field. If the acrylic family members can be separated so that methacrylates, acrylates, and acrylonitrile materials can be identified one from another, the users of such materials would be most appreciative.

Design Competition

A DESIGN competition for plastics molders will be sponsored by Koppers Co., Inc., Pittsburgh 19, Pa.

An impartial panel of authorities in the design, engineering, and marketing fields will act as judges. The panel will consist of Raymond Loewy Associates, industrial design consultants; Dr. Jesse H. Day, editor of the *S.P.E. Journal;* and Dr. Hugh G. Wales, Professor of Marketing at the University of Illinois and secretary of the American Marketing Association.

Three scholarships lead a list of awards to be presented by Koppers to first prize winners in three competitive product classes. The awards will be grants of a one-year, full tuition scholarships for studies related to product design at a qualified college or university chosen by each of the winning molders. Each scholarship will bear the name of the winning molder and will be awarded to a qualified student selected by the college or university.

Products entered in the contest may be molded or extruded of any regular or modified polystyrene and must be designed and produced by the molder for sale as a housewares item. All molders of polystyrene housewares, regardless of whose material they use, are eligible to enter the competition.

Entries will be considered and awards made in three categories as follows: Class I — utilitarian products with operative construction features; Class II — utilitarian products with non-operative construction features; and Class III — decorative products with or without operative construction features. A production sample of each entry to be judged must be received by Koppers no later than January 30, 1955.

Winners will be announced and awards presented at an industry banquet in Pittsburgh to be sponsored by Koppers on March 21, 1955.

Plastics Aid Small Businesses

FROM fountain pens to automobiles, plastics make valuable contributions to improvements in mass production methods, according to H. K. Intemann, vice president of Bakelite Co., in a recent speech delivered before the Boston Conference on Distribution. His further comments on the subject were as follows:

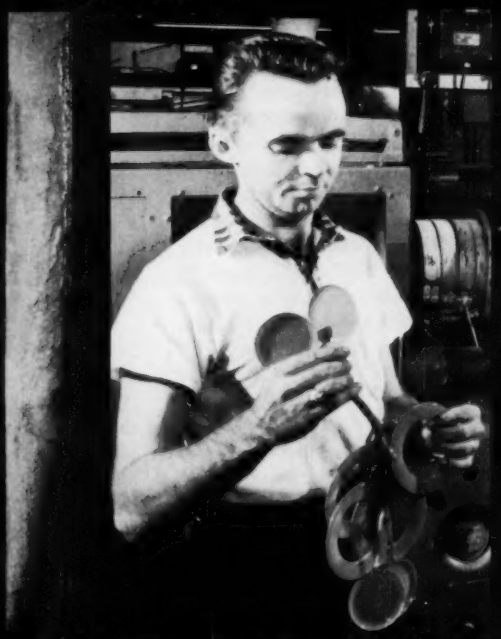
"Helping to maintain and continually expand our economy is the preponderance of small businesses which are a part of the plastics industry. These small businesses are the vital breeding ground for new products, services, and methods of distribution upon which expansion must be based. The low capital investment required by such businesses gives them mobility since it becomes easier to move the plant rather than the product to the market. Plastics fabricating machinery is relatively light and easy to move compared to the presses and mills of the metal working industries. The comparative lightness of plastics makes it easier to move the raw material rather than a bulky fabricated product. Due to this mobility and adaptability, these small units of the plastics industry thrive almost anywhere, spreading new industry around the country and fostering new economic growth in new localities. This supplies a movement in the opposite direction to the long prevailing trend toward concentration of industry, and therefore of population, in certain specialized manufacturing centers.

"Since plastics are neither mined

"LUSTREX HI-FLOW 55 – the greatest improvement in styrene in years!"

Mr. Henry Frey, Plant Supt.
Banner Plastics Company
Paterson, New Jersey

Toy dishes, molded of Lustrex Hi-Flow 55 are ready for easy removal from Banner Plastics Company's injection machine. Rejects and breakage are cut to a minimum!



Runners and gates are snapped off with ease because Lustrex Hi-Flow 55 is less brittle and stronger than ordinary styrene.

Speed cycles – cut costs – boost profits with HI-FLOW 55 MONSANTO LUSTREX® Styrene Plastic

"Monsanto's Lustrex Hi-Flow 55 is one of the finest improvements in styrene I've seen," says Mr. Frey. "Because it is far less brittle than ordinary styrenes, releases more easily from the mold and requires fewer stops for lubrication, Lustrex Hi-Flow 55 styrene has saved *2 to 3 seconds on our cycle time!* And we're getting *5% more production* per man, per machine!"

These results are typical of what happens when Lustrex Hi-Flow 55 styrene enters the molding picture. Lustrex Hi-Flow 55 molds at *25° to 50° lower* than general-purpose styrenes – eliminates surface flaws and weld marks; makes strain-free parts. Rejects are cut to a minimum. This soft-flowing styrene molding powder can be used in any standard injection, compression or extrusion machine.

Put Lustrex Hi-Flow 55's work-saving, cost-cutting advantages to work for you today. It's perfect for packaging and food containers, pin-point gating, deep draws, and uniform thick or thin wall sections where general-purpose styrene has trouble in filling.

For full information, write MONSANTO CHEMICAL COMPANY, Room 2613, Springfield 2, Mass.

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like iron, nor grown like wood, but are put together from available chemicals, this industry enjoys a degree of freedom from geographical limitation held by few, if any, of the established basic industries. Most of the plastics industry is free to move either towards sources of plentiful raw materials, plentiful labor supply, good transport facilities, or the eventual market place.

"Thus this industry is singularly adaptable to shifts and changes in the economic structure which cause new and pressing distribution problems. Without elaborate or costly adjustments, it can adapt itself to large population movements, market shifts, industrial relocation, and high delivery costs or freight rates.

Polyester Putty

FIRST glass-filled polyester molding putty to be made in Canada is now available to molders and fabricators from Waldor Enterprises, 3571 Hutchison St., Montreal, Que. The molding putty is for use in the fabrication of glass reinforced parts where molding difficulties are encountered with standard methods.

Waldor states that when the cross section of the piece to be made changes rapidly or is very irregular, the use of glass reinforcement in the form of cloth or mat or the use of a preform operation can become time consuming and expensive. Putties, which contain the glass reinforcement in chopped form, are easily molded into irregular shapes even when rapid changes in cross section occur.

The new molding putty uses Atlac 382 polyester resin, supplied by Atlas Powder Co., Canada, Ltd.

Fire-Retardant Panel

SELF-EXTINGUISHING sheets for use in skylighting for industrial buildings, schools, and other institutional buildings is now available from Resolite Corp., Zelienople, Pa., manufacturers of translucent structural fibrous glass-polyester resins panels.

Designated as Fire-Snuf, the new flame-resistant panels are molded with Hetron, a self-extinguishing resin produced by Hooker Electrochemical Co. The panels have a flame spread rating under 75 as measured by independent laboratory tests. This rating is in a bracket termed "slow-burning" by Building Officials Conference of America, Inc. The flame spread rating for red oak is 100 and for some veneered wood panels 500 and over.

Tough Pipe

GOOD impact resistance and toughness are claimed for a new corrosion-resistant, rigid styrene copolymer pipe recently announced by American Hard Rubber Co., 93 Worth St., New York 13, N. Y.

Called Dur-Ace, the pipe is for general-purpose use and is capable of handling most common corrosives. It is said to have excellent resistance to all inorganic acids and alkalies with the exception of a few strong acids. Though satisfactory for petroleum products generally, Dur-Ace has limited resistance to organic solvents. The moisture absorption rate is low. The pipe maintains good strength, rigidity, and chemical resistance over a temperature range from —40 to 170° F. Extended field tests have provided specific performance data for a wide variety of corrosive liquids and gases.

The company states that Dur-Ace saves the expense of maintenance painting even in the presence of strongly corrosive fumes. Electrolytic corrosion, bacteria, fungi, etc., have no effect on Dur-Ace; hence it is claimed to be suitable for many applications such as buried water lines, outdoor crude oil lines, gas lines, brine lines, etc.

The pipe is now supplied in sizes from ½ to 2 in., in standard 20-ft. lengths, with choice of two wall thicknesses, Extra Heavy Duty (IPS Schedule 80), and Standard (IPS Schedule 40). Fittings, flanges, nipples, etc, are also available of Dur-Ace, with standard IPS threads.

The pipe is not recommended for temperatures above 170° F. nor for temperatures below —20° F. where physical shock is present.

With the introduction of Dur-Ace, American Hard Rubber now offers eight different types of corrosion-resistant pipe, fittings, and tubing. Among them are materials suitable for high pressures and/or high temperatures, for handling difficult corrosives including strong acids and organic solvents, and for larger installations to 24-in. pipe size and up.

Color for Polyesters

AVAILABILITY of a new, improved line of colored polyester gel coats for polyester glass reinforced lay-ups or moldings, called Duolite #362, has been announced by Chemical Process Co., 901 Spring St., Redwood City, Calif. The resins are claimed to be strong, fast setting, and good leveling coatings for use against the mold to give a permanent, dense color finish to the molded part.

Duolite #362 has been used for boats and car bodies, and is available in red, white, blue, yellow, green, light blue, light green, and gray. Because of the fast setting qualities, production cycles can be reduced, and finishing operations minimized, depending upon the surface of the mold.

Technical information and product samples may be obtained from the company's Polyester Div.

Padding

MADE of cellular polyvinyl chloride, a new material, called Vinylairé, has been put on the market by Dura-Flex Co., 2043 Colorado Ave., Santa Monica, Calif. The material was primarily developed as an all-around athletic shock absorbent padding for body protection.

Vinylairé is available in economical sheet stock for either slow or quick recovery and as soft or as hard as customers' specifications demand.

Color-Free Polyester

PRODUCTION of a new color-free polyester resin designed for the manufacture of corrugated and other architectural panels, together with the inauguration of a technical assistance program for fabricators using such resins, has been announced by Celanese Corp. of America's Plastics Div., 180 Madison Ave., New York 16, N. Y.

The new product, called Marco MR-28RC, has a color index 25% lower than the A.P.H.A. industry standards, and is available without

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a price premium. It can be readily light-stabilized with an additive, or can be supplied with the light stabilizer included. Celanese representatives will recommend stabilizers and will assist in the production of long-lasting and fade-resisting laminates.

Parting Agent

TRADENAMED Lunn-Lease, a new spray-type, film-forming parting agent specifically developed for reinforced plastics bag molding processes at Lunn Laminates, Inc., is now being distributed nationally in drums through Arrow Sales Co., Mineola, N. Y.

The new formula contains seven components. The carrier evaporates immediately when sprayed on the mold, leaving a uniform, durable finish which is not tacky. It can be successfully applied as thin as 0.001 inch.

Further information may be obtained from Arrow Sales Co., 129 Mineola Blvd., Mineola, N. Y.

Atomic Polyethylene

A METHOD whereby atomic radiation is utilized to change ordinary plastic into a plastic material that will withstand temperatures as high as 350° F. has been announced by American Agile Corp., 5461 Dunham Rd., Maple Heights (Cleveland), Ohio. This material, plus numerous examples of the finished products, were exhibited for the first time at the Eighth National Chemical Exposition in Chicago, Ill.

Of far reaching importance to industry in general, and particularly to the chemical processing, food processing, and electrical industries, the material, known as Agilene-HT, consists of ordinary polyethylene whose molecular structure and such properties as its heat resistance and tensile strength have been altered by subjecting it to a bombardment of sub-atomic particles of high energy.

The company states that the mechanical properties of the irradiated plastic material, such as tensile strength and elongation, are considerably improved and these desired properties are retained at elevated temperatures. A marked increase in solvent resistance is encountered. In addition, limitations of ordinary polyethylene, such as stress cracking in certain environments, are completely eliminated.

For other details on the effect of radiation on polyethylene, see "Irradiated Polyethylene," MODERN PLASTICS *31*, 100 (April 1954) and "Highly Intense Radiation Fields," MODERN PLASTICS *32*, 131 (November 1954).

Meta-Phenol

IMPROVEMENT in color of its *meta*-Phenols 220 has been achieved through special processing, according to Carbide and Carbon Chemicals Co., a Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y. Prior to the introduction of this technique, *meta*-Phenols 220 were produced with an initial color of about 12.5 Gardner which later darkened considerably. The present product has an initial color less than 2 Gardner and will not darken beyond 3 Gardner, according to accelerated aging tests.

The company states that the improvement of color should be of special interest in the manufacture of resins for casting and surface coating and the manufacture of paint driers and vinyl stabilizers.

Improvement of *meta*-Phenols 220 is an example of the type of work being done on coal-hydrogenation chemicals to produce more highly refined products. Additional information may be obtained from Carbide and Carbon Chemicals Co.

Light-Stable Polystyrene

OF PARTICULAR significance to the lighting field is a new light-stable formulation of polystyrene developed by The Dow Chemical Co., Midland, Mich.

Designated as Styron 647, the formulation is claimed to offer eight to ten times better light stability than general-purpose polystyrene, while retaining the characteristic physical and chemical properties of the general-purpose material. Stabilization of the polystyrene results in non-yellowing crystal and white colors, the most commonly used colors for light fixture parts.

Styron 647, priced the same as the general-purpose type, will also be used for interior display signs, escutcheons, instrument dial faces and panels, venetian blind components, and window shade pulls.

Urea and Melamine Colorants

MATCHED-TO-SAMPLE dry colorants for urea and melamine, as well as for styrene, polyethylene, and other thermoplastics, are now being manufactured by Riverdale Color Co., 425 South St., Newark 5, N. J.

The company claims that this is the first time users of melamine and urea powders can, on short notice, mix any quantity of any color they may need.

According to the producer, users of Riverdale's urea and melamine colorants save up to 20¢ a lb. over small lots of conventionally manufactured special colors.

Resistoflex Annual Report

ANNUAL report of Resistoflex Corp., Belleville, N. J., for the fiscal year ended June 30 reveals a $134,000 increase in net worth to $981,636, a $170,000 gain in net working capital to $628,583, and a ratio of current assets to current liabilities of 3.7 to 1, compared to 2.0 to 1 in the previous year.

Edgar S. Peierls, president of Resistoflex, told stockholders that the company is in excellent condition to benefit from growing acceptance of its recently introduced Fluoroflex-T R500 hose and Fluoroflex-T laminated pipe, made of fluorocarbon resins.

Sales for the year ended June 30 total $3,112,268, a decrease of 11% from the 1953 record high of $3,495,481. Adverse factors were concentrated primarily in the early months of the fiscal year and can be ascribed to a relative inactivity in many industries in which Resistoflex products are widely used. Net profits of $104,105 after taxes were only 2% lower than the $106,322 reported in 1953.

Resistoflex also announces that it has concluded a license agreement with an English company for the production and distribution of its products; that a new and larger

plant is now under construction in the northern New Jersey area; and that the company is now in the process of expanding an assembly station in Los Angeles, Calif., into a full-scale warehouse and assembly plant to serve the entire West Coast.

Pipe Fittings

TWENTY-SEVEN new special-purpose fittings for flexible plastics pipe have been added to its line of standard adapters, couplings, tees, and ells, according to an announcement from Franklin Plastics, Inc., Franklin, Pa. It is claimed that shapes and features are included which were never before made in plastics. The new line consists of extra-length couplings, adapters, and elbows for water well installations; long and short adapter elbows to simplify linkages used in jet pump hook-ups; and insert reducing tees with female threads in the stem.

The company's insert reducing tees are designed for use in lawn sprinkler systems and other applications where it is necessary to branch from a plastics pipe with a smaller metal or plastics stem. A companion line of reducer bushings and plugs is also provided.

Phenolic Price Increase

AN increase in the price of three types of shell molding phenolic resins has been announced by General Electric Co.'s Chemical Materials Dept., Pittsfield, Mass. The new price is 26¢ a lb. for carload quantities, 27¢ a lb. for truckload quantities, and 28¢ a lb. for less than truckload quantities.

In connection with this adjustment, James W. Raynolds, manager of the department, states: "The present prices of shell molding resins do not allow the resin manufacturer a proper return for the high-quality resins required. The actual rate of shell molding resin consumption has fallen far short of previously published forecasts, due largely to low business levels in the foundry industry as a whole."

Resin-Glass Producer

SEVERAL resin-impregnated fibrous glass products have been announced by Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.

The developments include radomes, fibrous glass laminates, and plastic sandwich structures to operate at temperatures up to 500° F. These are specialized laminate materials molded to specifications by the company. Properties of the material at room temperature are: flexural strength, 65,000 p.s.i.; modulus of elasticity, 2.9×10^6 p.s.i.

Another development is Stycast 62, a new low-loss plastic impregnant for capacitors, filters, and r.-f. coils. The material is supplied as a low-viscosity liquid which, when cured to a solid plastic, has outstanding electrical properties and a useful temperature range from —55 to 125° C.

Stycast 62, available in quantity, is shipped with complete instructions for use.

Butyl Decyl Plasticizer

COMMERCIAL quantities of butyl decyl phthalate are now available from Monsanto Chemical Co.'s Organic Chemicals Div., St. Louis 4, Mo. The product, designated as Santicizer 603, is a companion product for Santicizer 160 in the primary pthalate plasticizer market. Its major application will be in polyvinyl chloride and vinyl chloride polymers.

Santicizer 603 imparts low-temperature flexibility, greater plastisol viscosity stability, and slower fusion or solvent action to vinyl compounds, according to the producer. It is well adapted to application in free film or sheeting, plastisols, and extrusions.

The new plasticizer is available in bulk shipments at 27¢ a lb. from Monsanto's plant in Everett, Mass.

Milk Truck Body

ANNOUNCEMENT has been made by Strick Co., Philadelphia 24, Pa., that the company has been commissioned by Carnation Milk Co. to manufacture an all-plastics milk truck body.

Strick is using fibrous glass reinforced polyester on this project. The pilot model is being fabricated by the hand lay-up method. The body itself will consist of just two symmetrical parts bolted together through a Neoprene gasket. These halves will contain fibrous glass insulation, as will the floor and the two bulkheads.

Because of their greater insulating efficiency, plastics milk truck bodies will cost much less to refrigerate, Strick officials predict. In addition, because the body is corrosion-proof, moisture will not be able to leak into and attack the insulating material. As the body is made of a milk-white material, painting will not be necessary, and the finish will be permanent.

Mylar Plant in Production

COMMERCIAL manufacture of Du Pont's Mylar polyester film has started at the company's new plant in Circleville, Ohio.

Anticipating lower costs as production goes up, the company reduced prices 15¢ a lb. on all types and gages of Mylar, except 25 gage, the thinnest film. The reduction puts Mylar in the price range of $2.85 a lb. for heavier films to $4.00 a lb. for 25-gage film.

In a letter to customers, J. Edward Dean, director of sales of Du Pont's Film Dept., said: "This price reduction is made in anticipation of lower costs which we are confident can be achieved as experience is gained with larger scale of manufacturing."

Teflon-Silicone Tape

RESISTANT to many reactive chemicals and drastic temperature changes, a new pressure-sensitive tape for industrial use has been developed by Minnesota Mining & Mfg. Co., St. Paul, Minn.

Made from Du Pont's polytetrafluoroethylene resin, the tape—"Scotch" Brand No. 549—combines all the properties of Teflon film with the chemical and heat-resistant properties of a pressure-sensitive silicone adhesive.

The semi-transparent, blue-gray colored tape is designed for quick and easy application to a wide variety of surfaces as a protective covering material. Around small rollers, for example, it offers anti-sticking properties and provides chemical protection to the roller material.

Plexiglas R

STOCK of Plexiglas R cast acrylic sheets for immediate delivery is now available from Cadillac Plastic Co., 15111 Second Ave., Detroit 3, Mich.

Plexiglas R is a low-cost cast acrylic suitable for many applications where the superior optical quality of Plexiglas II UVA is not required. Plexiglas R sheets are

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claimed to have the same excellent outdoor weathering characteristics and physical properties as Plexiglas II UVA. They are not, however, manufactured to the same standards of optical quality, surface quality, and thickness tolerances.

Mobay Officers

APPOINTMENT of key managerial personnel of the newly formed Mobay Chemical Corp., St. Louis 4, Mo., has been announced by David L. Eynon, president of the company, as follows:

Dr. H. H. Wollthan—vice-president and technical director in charge of production, engineering, and research; Robert H. Kittner—development director; Dr. Edgar E. Hardy—research director; James D. Mahoney—general manager of sales; and J. C. Warner—secretary-treasurer.

Dr. Wollthan was formerly associated with Farbenfabriken Bayer, A. G., Leverkusen, Germany, where he was in charge of isocyanate process research, development, and production.

Filler for Plastics

THE use of Wollastonite as a mineral filler for polyester resins has been growing rapidly since its introduction in 1952 by Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass. The material is an almost theoretically pure, brilliant white calcium metasilicate.

Wollastonite grinds now commercially available to industry vary from a coarse 20-mesh grade to one which shows 99.9% through a 325-mesh screen. The material is unique in that it also lends itself by special grinding processes to the formation of fibrous material. Some of the grinds have fibers with a length-to-diameter ratio of 13 to one. The 20-mesh grind can also be considered a coarse fibrous product because Wollastonite is acicular in its natural form.

It has been found that Wollastonite in molded plastics contributes two to four times greater impact strength, a smoother surface to the finished product, and excellent dielectric strength. The color of light-colored articles is made cleaner and brighter with the use of Wollastonite.

Two grades of the material are now available in commercial quantities for the reinforced plastics industry—Wollastonite P-1 and Wollastonite P-4. Wollastonite P-1 can be used in polyester molding compounds at high concentrations without exceeding a practical working viscosity. It imparts to the compound a smooth surface, whiteness, and low water absorption.

Wollastonite F-1 is one of several grades characterized by a fibrous or needle-like particle shape. This property, uncommon in mineral fillers, can be used to advantage in polyester resins.

Release Agent for Epoxies

INCREASED utilization of epoxy resins for industrial tooling is anticipated by Rezolin, Inc., 5736 W. 96th St., Los Angeles, Calif., as a result of the introduction of a new mold release agent developed by that company. This formulation is claimed to be effective in releasing epoxy resins from plaster, wood, Toolplastik, and metallic molds.

Designated as PrEpoxy Partingkote 832-A, the material is a film-forming, low-shrink plastic solution with a black color which minimizes the possibility of misses or thin areas in the applied parting film. It is a ready-to-use material which may be sprayed or brushed onto the mold, according to the user's preference.

Glass-Silicone Laminate

ADDITION of Synthane G-7, a glass-silicone laminate, to its line of high-strength, high-pressure thermosetting plastics materials has been announced by Synthane Corp., Oaks, Pa. The material is claimed to combine heat-stable silicone resins with layers of woven glass fabric to achieve higher heat resistance than any laminate thus far developed.

Capable of withstanding constant temperatures of 400° F. without affecting either the mechanical or electrical values, G-7 is particularly suited to a great number of electrical and electronic applications where components are subject to high ambient or operating temperatures. Silicone laminates have found widespread use as a design material in military equipment. Synthane G-7 is manufactured to conform to MIL-P-997, type GSG.

Color Effects

TWO NEW color and finishing effects, Stipple X-88 and Spatter R-69, have been developed by Logo, Inc., 13799 South Avenue O, Chicago, Ill. The non-finger-printing and defect coverage of Stipple and the unusual and striking color effects of Spatter suggest broad usage in the plastics field, according to the producer.

Stipple X-88 is a stipple coating which forms a discontinuous film producing a textured base for use on most plastics and a variety of other surfaces prior to applying a regular Logoquant finish.

Spatter R-69 produces a spatter effect and is applicable to either the first surface of opaque plastic or the second surface of transparent plastic. Spatter produces a thin discontinuous film of any selected color which, for second surface application, is then backed by any contrasting color for the desired effect. For first surface application of Spatter, the reverse procedure applies, with the continuous color coat sprayed first and the Spatter applied last. Any two-color combination is possible for either plastic surface.

Panelyte in Vacuum Forming

AS A result of its recent entry into the vacuum forming field, St. Regis Paper Co.'s Panelyte Div. announces that it is now able to provide its customers with plastics products in three major fields—high-pressure laminating, injection and compression molding, and vacuum forming.

Panelyte's new vacuum forming plant is located in Richmond, Ind., which is also the location of the second plant of Cambridge-Panelyte Molded Plastics Co.

Foreign Growth

CONSUMPTION of plastics in countries outside of the United States is expected to increase 140% by 1960 over 1950. Production of polyester fibers alone is expected to reach a

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rate of 90 million lb. annually outside of the United States, not including the 10 million lb. capacity under construction in Canada. Vinyl fiber capacity by 1956-57 should reach some 95 million pounds.

These figures were given to members of the Commercial Chemical Development Assn. at the fall meeting by M. F. Mitchell, general manager of chemical industry administration of Shell Petroleum, Ltd.

Consulting Chemists

AT THE annual meeting of the Association of Consulting Chemists and Chemical Engineers, Inc., 50 E. 41st St., New York 17, N. Y., the following officers were elected:

President: Charles Davidoff, 198 Broadway, New York, N. Y.

Vice president: Lincoln T. Work, 420 Lexington Ave., New York, N. Y.

Secretary: Elliott A. Haller, president of Haller Testing Labs., Inc., 801 Second Ave., New York, N. Y.

Treasurer: Percy E. Landolt, Landolt & Whitney, 36 W. 44th St., New York, N. Y.

Color for Vinyl Extrusion

STANDARD prematched vinylized colors are now available to extruders of vinyl shoe welting, upholstery gimp, and luggage trim, according to an announcement from Claremont Pigment Dispersion Corp.'s Vinyl Products Div., 110 Wallabout St., Brooklyn 11, N. Y. Among the colors are such popular shades as town brown, mahogany, and fawn.

The company asserts that the materials are ideally suited for easy incorporation into dry blend compounds by drum tumbling or proportioning meter attachments.

Acrylic Binder

DESIGNED for use as a binder for glass mats and molding preforms, an emulsion which will not discolor during drying or subsequent molding operations has been developed by Rohm & Haas Co., Philadelphia 5, Pa.

Designated as Binder P-812, it is claimed that this acrylic-type water emulsion forms a hard, colorless, thermoset polymer when heated. Advantages over existing binders for fibrous glass are said to be: 1) forms clear, water-white polymer that resists discoloration at elevated temperatures—can be subjected to 450° F. for 5 min. without discoloring; 2) easily prepared for application—simply dilute with water; 3) excellent wetting power and adhesion to fibrous glass; 4) insoluble in styrene and other organic solvents; 5) will not flow at high temperatures; 6) excellent mechanical and storage stability.

Further information, including technical notes, may be obtained from the company's Resinous Products Div.

Teflon-Coated Wire

EXPANDED manufacturing facilities at Hitemp Wire, Inc., 26 Windsor Ave., Mineola, N. Y., have enabled the company to offer extruded Teflon-coated wire for high-temperature service (Class H or better). The first item produced by the company is a stranded hook-up wire, tradenamed Temprex.

The new wire is manufactured in a range of sizes. Fourteen standard colors are available for applications where wire identification is a problem.

Additional information on the wire, or engineering assistance on high-temperature problems, may be obtained from George Newman, Jr., sales manager of the company.

Ethylene Cyanohydrin

AVAILABILITY of ethylene cyanohydrin in tank car, tank truck, and drum carload quantities has been announced by Carbide and Carbon Chemicals Co., a Div. of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Ethylene cyanohydrin is important in the synthesis of acrylonitrile, polyacrylic acid, polyacrylates, as well as other acrylic derivatives, and in the manufacture of resins and plastics. It is used as a solvent in the manufacture of cellulose esters, fibers and plastics made from acrylonitrile polymers, and many inorganic salts. The product is also an effective inhibitor and color stabilizer in the polymerization of acrylonitrile.

Strapping Tape

MANUFACTURE of Permacel 16 Hi-Tack strapping tape in a range of colors has been announced by Permacel Tape Corp., New Brunswick, N. J. Originally available in transparent only, the new product is now also being marketed in white, black, and colors.

A rayon-reinforced cellulose acetate tape, Permacel 16 is claimed to have excellent shock resistance. When used on corrugated packing material, Permacel 16 is said to be superior to wire or steel strapping as it will not chafe through the material.

Wall Tile Cement

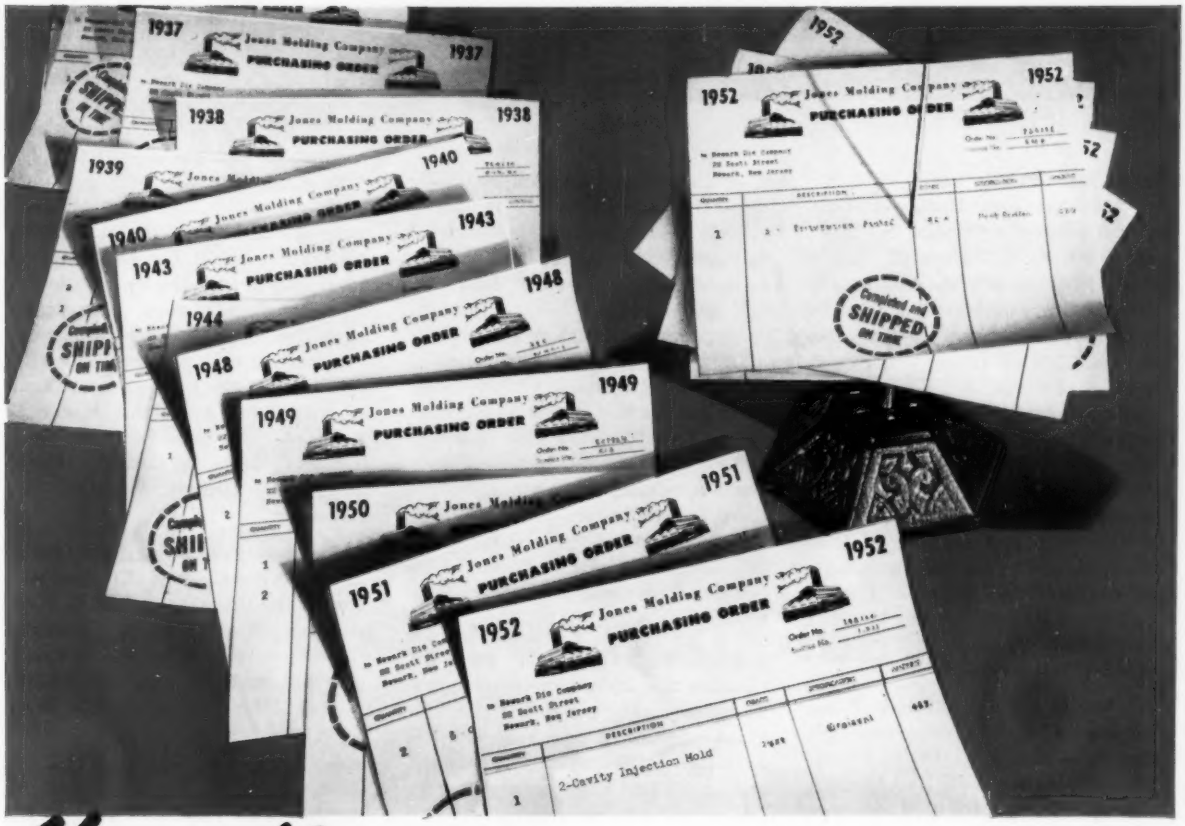
TESTS on an improved resin-type adhesive for use in the installation of polystyrene and other nonceramic types of wall tile have been completed by Industrial Products Div., The Flintkoke Co., 30 Rockefeller Plaza, New York, N. Y.

The company's research technicians report that the material's accelerated aging at 158° F. showed less embrittlement than competitive types, indicating lasting toughness in the cement film.

EXPANSION

The General Tire & Rubber Co., Akron, Ohio, dedicated a $6 million polyvinyl chloride resin plant in Ashtabula, Ohio, on October 21. The company claims to rank as one of the world's largest integrated manufacturers of plastics film and plastics sheeting. Last April 30th, **Bolta Corp.**, Lawrence, Mass., and **Textileather Corp.**, Toledo, Ohio, were merged into General Tire. A calendering plant has been in operation in Jeannette, Pa., for several years.

The plant's 14 major operating buildings and eight auxiliary buildings are geared for an annual production of 25 million lb. of polyvinyl chloride resin. Pointing up the interlocking chemical industry in Ashtabula is the fact that the two basic raw materials used in the manufacture of P.V.C. — pure acetylene gas and hydrogen chloride — will be piped in by neighboring industries. **Electrometallurgical Div. of Union**



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Carbon and Carbide Corp. will supply acetylene and **Hooker-Detrex Co.** will furnish hydrogen chloride.

Employment at General Tire's Ashtabula chemical plant is approximately 150, consisting of 30 administrative and supervisory employees, and about 120 operating employees. **James A. Pollock,** a veteran of 20 years in the production and engineering phases of the chemical industry, has been named factory manager.

Contractor of the plant was United Engineers & Constructors, Inc., Philadelphia, Pa.; process equipment was designed by Scientific Design Co., New York, N. Y.; and General Tire's Central Engineering Dept. coordinated the project.

United Gas Corp., Electric Bond & Share Co., and **National Research Corp.** have been engaged in a joint research program since 1950 directed towards the development of new chemical processes based on the use of natural gas and its constituents. The actual research has been conducted by National Research Corp. at Cambridge, Mass. United Gas and Electric Bond & Share each own a 40%, and National Research a 20% interest in the results of the program.

As a result of this research, United Gas has now filed with the Securities and Exchange Commission, Washington, D. C., a request to acquire an interest in a newly formed company to be known as Gulf Chemical Co. The proposed transaction, as outlined in United's request to the Securities and Exchange Commission, further stated:

"Gulf will engage in the manufacture and sale of ammonia, ammonium nitrate, and other nitrogenous materials for industrial and agricultural uses and in the manufacture, processing, and sale of other chemicals, including polyvinyl chloride.

"The program contemplates that Gulf erect a plant for the manufacture from natural gas of the various products described above. The plant is being designed for an initial daily capacity of 200 tons of anhydrous ammonia (part of which will be converted into nitric acid and ammonium nitrate) and for an initial daily capacity of approximately 40 tons of polyvinyl chloride. It is estimated that the ammonia facilities will be in operation by January 1956 and the polyvinyl facilities will be in operation shortly thereafter.

"It is expected that the initial plant and facilities, which are presently proposed to be erected near Pensacola, Fla., will cost approximately $22,920,000. In addition, working capital is estimated to require approximately $3,880,000. The total investment in plant and facilities, including working capital, is estimated at approximately $26,800,000."

Reichhold Chemicals, Inc. announces that its new polyester plant in Azusa, Calif., is now in operation. Plant capacity of polyester resins is estimated at 10 million lb. annually, and provisions have been made for additional units as needed.

Southeastern Sales Corp., 1705 Central Ave., St. Petersburg, Fla., has completed an expansion program at its fabricating plant by the addition of 2500 sq. ft. of warehouse space and two pantograph engravers. The company specializes in fabricating plastics signs, industrial parts, machinery guards, and display fixtures.

Solvay Process Div., Allied Chemical & Dye Corp., 61 Broadway, New York 6, N. Y., announces that its new chloromethane plant in Moundsville, W. Va., is now in operation and will produce, among other things, methyl chloride and methylene chloride.

Methyl chloride will be sold in tank car lots f.o.b. Moundsville, W. Va., freight equalized with recognized producing points. Methylene chloride is being offered on a delivered price basis in drum or tank car quantities.

Riverside Plastics Corp., Miller Rd., Hicksville, N. Y., has opened its new plant, comprising an area of 16,100 sq. ft. on a 3½-acre site, for the manufacture of structural and non-structural reinforced plastics parts for fighters, bombers, helicopters, and commercial aircraft. One of the most recent Riverside products is a new type of seat, combining increased strength at lighter weight, for use in both military and commercial planes.

Riverside Plastics was incorporated in January 1951 and was originally located at 71 Baruch Place, New York, N. Y. The company has pioneered in the development of reinforced plastics parts and assemblies for the aircraft, electronic, automotive, and marine industries.

Officers of the company are **Frank J. Nussbaum,** president; **Harry C. Tomford,** vice president and sales manager; **John E. Haigney,** secretary; and **George Menaker, Jr.,** treasurer.

Accurate Perforating Co., 1101 S. Kedzie Ave., Chicago, Ill., has purchased the property at 3436 S. Kedzie Ave. from Western Foundries Co. The newly-acquired property provides Accurate with an additional area of 220,000 sq. ft. on 545,000 sq. ft. of land.

The Conart Co., Inc. has moved to its new plant in Glen Head, N. Y. At the new plant the company has augmented its production capacity and installed numerous devices and machines to improve and control the quality of production. Conart, supplier of molded closures to drug, cosmetic, and chemical firms, also produces electrical parts and other plastics items using large-volume production methods.

National Starch Products, Inc., 270 Madison Ave., New York 16, N. Y., has purchased a tract of land in Meredosia, Ill., and has started construction of its second vinyl resin plant. This plant will supplement the production of National's Plainfield, N. J., resin plant. The company plans to manufacture principally vinyl acetate polymers and copolymers at the new location.

COMPANY NOTES

The Dow Chemical Co.'s Plastics Production Dept., Midland, Mich., announces the following promotions: **Max Key,** formerly in charge of the Saran-Polyvinyl Chloride Section, has been promoted to the newly established post of assistant production manager in charge of the department's Midland production operations. He will have administrative

responsibility for production in the Cellulose, Saran, Styron, and Vinyl Toulene Sections. **A. T. Maasberg,** former head of the department's Cellulose Products Section, has been advanced to the newly created position of technical director of the department. His new duties will include the general administration of research and development, cooperation with section superintendents on plastics process and product activities, and general liaison work with other plastics groups.

Quaker Pioneer Rubber Mills, Div. of H. K. Porter Co., Inc., Pittsburg, Calif., has purchased the lawn hose division of **Extruders, Inc.,** Hawthorne, Calif. The purchase will enable the division to expand its lawn hose manufacturing facilities and increase customer service. In addition to lawn hose, Quaker Pioneer manufactures and distributes a complete line of industrial rubber products, including belting, hose, and packings.

Extruders, Inc. will continue to produce polyethylene film.

Hatco Chemical Co. has completed its first year at its new and larger plant located on 64 acres near Fords, N. J. The multi-million pound per year plant comprises three buildings, in addition to out-of-doors reactors and storage tanks. A separate building houses the business offices of the company.

At the current time the principal products are phthalate, adipate, and sebacate esters used as plasticizers for vinyl resins. A number of new products, particularly in the polyester field, are being developed in anticipation of the growth which is expected for these materials in the isocyanate, or polyurethane, foamed resin field. A wide variety of organic chemicals, including alcohols, glycols, amines, esters, and ketones, can be processed. Shipping facilities are provided for small packages, drums, tank cars, and tank wagons.

Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y., announces the following territory changes in its chemical sales staff: **Julian S. Pruitt,** formerly sales representative in southern New Jersey, has been assigned to the Detroit, Mich., territory. He replaces E. J. McMullen who has resigned. **Evan E. Senuk** has been transferred from the middle Atlantic territory to cover southern New Jersey. **Lorne C. Stocker,** who recently joined the sales department, succeeds Mr. Senuk to handle the middle Atlantic area. He will make his headquarters in Charlotte, N. C.

Plastic Fabricating Co., Inc. has moved its plant and offices to 722 E. 9th St., Wichita, Kan.

American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., announces that **James W. Gilman** has been appointed sales representative in the Pacific Northwest for the **Plastics and Resins Div.** With headquarters at Cyanamid's Seattle office, Mr. Gilman will be responsible for sales and service of all the division's products in that region. **E. B. Cordon,** in charge of the West Coast technical service for the company's coating resins accounts, will continue to serve the San Francisco area as well as the southern California territory.

Pribble Plastics Products, Inc., 554 Eben St., New Haven, Ind., is the new name of the company formerly known as Barrier Pribble & Co., Inc. The company also announces that **John L. Haugsrud** has joined the organization as plant manager and **Jerome C. Jehl,** who has been design engineer for over five years, is now in charge of the design service.

New equipment, including a 28-ton Logan plunger press, has been added to increase the firm's capacity for molding thermosetting plastics.

James Mitchell & Son (Greenock) Ltd., Greenock, Scotland, has established a Plastics Div. **H. W. J. Pope,** formerly technical sales manager, has been named general manager of the division.

Respro, Inc., 530 Wellington Ave., Cranston 10, R. I., announces the election of the following officers: **Frederic H. Taber,** president of the company since 1921, has been named chairman of the board. **Raymond S. Newell,** former secretary, general manager, and treasurer, is now president. He was a former director of S.P.I. and is a present member of the Society's Vinyl Standards Education Committee. **Frederick R. Fitzpatrick,** former assistant general manager, has been named general manager; **Leonard J. Carey,** secretary and treasurer; **Colin MacR. Makepeace** continues as vice president of the company.

Kabar Mfg. Corp., 1907 White Plains Rd., New York 62, N. Y., has opened a new plant for the exclusive manufacture of heat sealing dies. The dies will be "tailored" for the machine on which they are to be produced. Each die will be pretested in the plant before delivery by making a commercial sample of the item for which the die is designed.

Marketing Agents, Inc., 207 Powell St., San Francisco 2, Calif., announces that **M. Walthall Turner,** formerly of Plax Corp., has been named sales manager of the company's **Plastic Products Div.** Marketing Agents has recently been appointed warehousing distributor for **Royal Mfg. Co.**

Primas Moldmakers, Inc., 240 Sheridan Ave. and 239 Dutton St., Buffalo, N. Y., is the new name of the company formerly known as Alex Primas. **Carl H. Dibble** is president of the firm.

Renaud Plastics, Inc., Lansing, Mich., makers of Ren-ite, a special tooling plastic, announces the appointment of **Betteridge & Co.,** Buhl Bldg., Detroit 26, Mich., to handle the advertising and promotional activities on Ren-ite.

Augusta Plastics, Inc., 3820 Boston Post Rd., New York 69, N. Y., has been recently formed and will specialize in custom injection molding and packaging. The company will offer a complete service to the trade, including product design and development, mold engineering, finishing, decorating, and assembly of plastics and metals.

Officers of the firm are **Arthur S. Jacobs,** president, and **Joseph J. Eder,** vice president. Mr. Jacobs was formerly in charge of Renewal Mfg. Co.'s Plastics Div. and Ideal Plastics Corp.'s Industrial Div. Mr. Eder has been in the packaging field for the past 16 years and was formerly with Victor Metal Products. For the past

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five years he has been vice president of **Stanley Sapery Co.** All sales will be handled by Stanley Sapery Co., whose offices will be at the Boston Post Rd. address.

Carbon Dispersions, Inc., 27 Haynes Ave., Newark 5, N. J., has named **Lukens Chemical Co.**, 227 California St., Newton 58, Mass., as its district sales representative for New England. The company specializes in the application of pigment dispersions in plastics and rubber.

Pittsburgh Plastics Corp., Arch St., Carnegie, Pa., announces the appointment of **William H. Young** as vice president and general manager and **T. O. Armstrong** as vice president of public and employee relations. Mr. Young will be in charge of production, engineering, and sales. His former affiliations were with Mack Molding Co., Arlington, Vt., as chief engineer, and with Brilhart Plastics Corp., Mineola, N. Y., as assistant general manager.

The Sierracin Corp., 1121 Isabel St., Burbank, Calif., announces that **Vance Danford** has joined its technical staff as standards engineer and **David Zachry** as research chemist. Mr. Danford was formerly connected with Triplett & Barton Testing Laboratories and Mr. Zachry was teaching fellow and research fellow at Baylor University.

Capac Industries, Inc., Capac, Mich., a new company, has taken over the equipment and facilities of the former Capac Plastics Div. in Capac. Capac Plastics recently discontinued operations after several years as a division of Molloy Industries, Inc., Minneapolis, Minn.

C. R. Paton, former director of engineering of Packard Motor Car Co., has been named president of the new firm; **P. C. Russell**, vice president; **E. H. Anderson**, treasurer; and **John H. Worley**, secretary.

Plans of Capac Industries include installation of new equipment which will permit the company to engage in several lines of plastics manufacturing. Principal items under consideration are laminated electrical sheet stock, laminated shapes, extruded polystyrene sheet, vacuum formed parts of various plastics formulations, and compression moldings.

Witco Chemical Co., 260 Madison Ave., New York 16, N. Y., announces the election of **Max A. Minnig** as executive vice president. Mr. Minnig joined the company's Natural Gas Div. in 1946 and successively has been national sales manager of rubber chemicals, director of sales, and vice president. **W. F. George**, formerly district sales manager of Hooker Electrochemical Co., has joined Witco as special assistant to the president.

Bernard McDermott, formerly of The Sun Rubber Co., Barberton, Ohio, has established a new free lance product design and development service for manufacturers. The new firm, located at 106 Avondale Drive, Akron 13, Ohio, plans to place particular emphasis on product and mold design for vinyl plastisol.

Mycalex Corp. of America, 125 Clifton Blvd., Clifton, N. J., announces that E. W. Falk has joined the company as commercial engineer and will cover the New York metropolitan area and New England. Mr. Falk comes to the company from General Electric Co., where for the past 25 years he had been a plastics sales engineer in G-E's New York office representing the plastics department of the Chemical Div.

Davidson Associates, 730 Fifth Ave., New York 19, N. Y., consultants and manufacturers' representatives, has been recently formed and will act as manufacturers' representatives for **Lumelite Corp.**, Pawling, N. Y., plastics injection molders, and **Surprenant Mfg. Co.**, Clinton, Mass., plastics extruders.

Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N. J., has appointed **Canadian Bronze Powder Works, Ltd.**, Montreal, Que., as exclusive distributor of its complete line of industrial adhesives.

The Fellows Gear Shaper Co., Springfield, Vt., has opened a western district office at 5 Martel Bldg., 6214 W. Manchester Ave., Los Angeles 45, Calif. The new office will maintain customer-manufacturer relations in western states. **Frank D. Sanborn**, who has represented the company on the West Coast for the past five years, will head the office.

Nopco Chemical Co., Harrison, N. J., anounces the following additions to its Plastics Div.'s sales staff: **Edward L. Trabold, Robert LeWitter**, and **Paul C. Luscusk** will join the field force; **Walter J. Major**, will be a member of the inside sales organization. In their new assignments, the appointees will concentrate on new industrial applications for Lockfoam, Nopco's foamed-in-place plastic for the aircraft, electronic, automotive, insulation, and other industries.

Fiberoid Doll Products Corp., 605 E. 132nd St., New York 54, N. Y., has added rotational molding apparatus to its present plastisol molding equipment and is now equipped to decorate the molded item. The company also offers free engineering service for new products.

PERSONAL

Bernard R. Garland, assistant control manager of **Du Pont's Polychemicals Dept.**, has retired after 30 years with the company. For the most part of his career with Du Pont, Mr. Garland was associated with the development of its plastics business. He was control manager of Du Pont's Plastics Dept. from 1936 until its consolidation with the Ammonia Dept. in formation of the Polychemicals Dept. in 1949.

John J. Rieck, formerly manager of the nylon project of **National Aniline Div., Allied Chemical & Dye Corp.**, 40 Rector St., New York 6, N. Y., has been appointed manager of the company's new Chesterfield synthetic fiber plant in Hopewell, Va.

Alfred F. Fields, a pioneer in plastics manufacturing with over 40 years experience in the field, has retired from **General Electric Co.**, Pittsfield, Mass. Mr. Fields entered th company's service in 1912, when he joined the Pittsfield Works Apprentice Course. He became a toolmaker in 1916, and has been continuously associated with the tool-

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making of plastics molds, in one phase or another, since that time. In 1925, he was named assistant foreman of the Plastics Dept.'s tool room and became a product engineer in 1932. Since 1948, Mr. Fields has held posts as assistant manager of the Pittsfield plastics molding plant and manager of the mold manufacturing plant.

Lawrence E. O'Donnell has been assigned to the plastics and resins group of **Hooker Electrochemical Co.**, Niagara Falls, N. Y. He was formerly with Lockheed and Kraloy Plastics.

Robert A. Huddleston has been named administrative assistant to **James S. Lunn**, president of **Lunn Laminates, Inc.**, Huntington Station, N. Y., and Ashtabula, Ohio. Mr. Huddleston was formerly associated with Allied Chemical & Dye Corp. and Carbide and Carbon Chemicals Corp.

Ben Davis, director of sales of **Davis-Standard Sales Corp.**, 14 Water St., Mystic, Conn., is on an extended tour in Europe for the purpose of studying problems related to the extrusion of plastics and rubber and the methods used in various European industries.

Charles Shepherd, former senior staff member of **Libbey-Owens-Ford Glass Co.'s Corrulux Div.** in Houston, Texas, is now production superintendent of Corrulux.

Robert D. San Filippo has been appointed manager of the contract packaging department of **Bradley Container Corp.**, Maynard, Mass., manufacturer of Bracon polyethylene collapsible tubes and squeeze-to-use bottles.

John P. Brecker is now plastics sales engineer of **Erie Engine & Mfg. Co.**, 953 E. 12th St., Erie, Pa. He will handle sales and servicing of the company's complete line of fibrous glass and compression molding presses.

Richard R. Blair has joined **Marbon Corp.**, a subsidiary of **Borg Warner**, as technical sales representative. With offices at 1163 Quimby Rd., Wooster, Ohio, Mr. Blair will cover the plastics, rubber, and paint industries in Ohio, western Pennsylvania, and eastern Michigan. His previous affiliations were with The Goodyear Tire & Rubber Co., Inc. and Rohm & Haas Co. in various technical capacities.

George "Bud" Bell has been selected to head up West Coast operations for **Resistoflex Corp.**, Belleville, N. J. Mr. Bell will be manager of the new bulk storage and assembly plant now being completed at 2919 Empire Ave., Burbank, Calif.

Frank J. Hines has joined **Catalin Corp.**, 1 Park Ave., New York 16, N. Y., and will be in charge of color development at the company's recently completed polystyrene plant in Calumet City, Ill. Mr. Hines was formerly connected with American Cyanamid Co. in a supervisory capacity relating to technical field service involving color problems.

Carl A. Carlsen, formerly with Scandinavian Airlines and Air Associates, Inc., has been appointed aircraft sales manager of **Resistoflex Corp.**, Belleville, N. J. The company produces flexible hose and hose assemblies for the aircraft and other industries.

George Waite has been appointed sales director of **Tech-Art Plastics Co., Inc.**, Ridgedale Ave., Morristown, N. J. He was formerly associated with Firestone, Celanese Corp. of America, and Curtiss-Wright Co.'s Plastics Div.

C. Paul Fortner has been elected vice president in charge of research and development of **Plax Corp.**, West Hartford, Conn. He joined Plax in 1952 as director of research and development.

Harold L. Danziger, formerly manager of the Special Brands Div., has been promoted to group manager in charge of the Automotive, Special Brands, and Universal Divs. of **R. M. Hollingshead Corp.**, Camden, N. J.

M. R. Tenenbaum has joined **Lester-Phoenix, Inc.**, 2621 Church Ave., Cleveland 13, Ohio, as sales and service representative of the company's die casting machines and injection molding machines in the Michigan area. Mr. Tenenbaum's former affiliations were with National Acme, Ward Product, and as chief metallurgist of Monarch Aluminum Mfg. Co. for 11 years.

Deceased

William B. Petzold, supervisor of design of **General Electric Co.'s** Laminated & Insulating Products Dept. A pioneer in plastics design and nationally recognized in his field, Mr. Petzold was the originator of hundreds of new designs, patterns, and color combinations for G-E plastics since 1928. He was the recipient of six MODERN PLASTICS design awards.

MEETINGS

Dec. 7-8—Society of the Plastics Industry, Inc., Fifth S.P.I. Film, Sheeting, and Coated Fabrics Division Conference, Hotel Commodore, New York, N. Y.

Dec. 12-15—American Institute of Chemical Engineers, Meeting, Statler Hotel, New York, N. Y.

Jan. 18-28, 1955—Provincial Exhibitions Ltd. and Institute of Packaging, Britain's Fourth International Packaging Exhibition, National and Empire Halls, Olympia, London, England.

Jan. 19-21—The Society of Plastics Engineers, Inc., will hold its Eleventh Technical S.P.E. Conference at the Hotel Chalfonte-Haddon Hall, Atlantic City, N. J.

Jan. 20-21—The Chemical Market Research Association and Commercial Chemical Development Association, Joint Meeting, Edgewater Beach Hotel, Chicago, Ill.

Feb. 8-10—Society of the Plastics Industry, Inc., Tenth Annual S.P.I. Reinforced Plastics Division Conference, Hotel Statler, Los Angeles, Calif.

Feb. 22-23—The Society of the Plastics Industry Canada, Inc., Thirteenth Annual S.P.I. Canadian Conference, Hotel London, London, Ontario.

April 6-10—World Plastics and Trade Exposition, National Guard Armory in Exposition Park, Los Angeles, Calif.

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Phone: Oregon 8-4711

INJECTION MOLDING MACHINES: 2—Reed-Prentice, 2 Oz.; 1—Watson-Stillman, 2 Oz.; 1—DeMattia, 2 Oz.; 2—Reed-Prentice, 6 Oz.; 2—Reed-Prentice, 8 Oz.; All in very good condition as recently removed from service. All Full Automatic Cycle Operation. 2—Lester, 4 Oz.; 1—Lester, 12 Oz.; Still in operation, inspection under power. EXTRUSION MACHINES: 1—MPM, 1951, 3 HP Sterling Speed-Trol Drive; 2—MPM, 1951, 40 HP M.D.; 1—MPM Pelletizer, 95% New, Capacity up to 1000 lbs. per hour. 1—Royle No. 1, Rubber, 5 HP M.D. ROTARY CUTTERS: 1—Cumberland No. 0, 2 HP M.D.; 1—Ball & Jewell Midget, Stainless Steel, 1 HP M.D. MIXERS: Baker-Perkins, Lab Size 6, Class BB, Stainless Steel Sigma Blades, Jacketed Body, arranged for Motor Drive. Banbury No. 1, Completely Chrome Plated Interior for Plastics, 50 HP Motor Drive, Oil Heating System, All Controls. HYDRAULIC PRESSES: All sizes and capacities from Lab size to 4000 Tons. Full details on request. Other sizes and makes of Plastics and Rubber Extruders; also Mills, Calenders, Mixers, Grinders, Pumps, Valves, Platens, etc. JOHNSON MACHINERY COMPANY, 683-P FRELINGHUYSEN AVENUE, NEWARK 5, NEW JERSEY. Tel.: Bigelow 8-2500. What have you for sale? What are you looking for?

SAVE WITH GUARANTEED REBUILT EQUIPMENT: 2 New R. D. Wood 500 ton embossing presses; 54"x26" platen, HYDRAULIC PRESSES; 40"x40", 36" ram, 1500 tons; 2—27"x27", 18" rams, 585 tons; 20"x20" 10" ram, 200 tons; 20"x20", 14" ram, 200 tons; 15"x15" 8" ram, 75 tons; 14"x14" 8" ram, 75 tons; 2—19"x24" 10" rams 78 tons; 18"x18", 7" ram, 50 tons; 10—26"x26" 7" rams, 50 tons; 12"x12" 7½" ram, 50 tons; 14"x14" 8" ram, 50 tons; 8"x9½" 4½" rams 20 tons; 16"x16" 3½" rams, 12 tons; Carver model 150 and 6"x6" LABORATORY PRESSES; Stokes Model T, late type with drive; Stokes Model T, late type with hydraulic equalizer system and drive; Colton 5½T with drive PREFORM PRESSES; NEW UNIVERSAL DUAL PUMPING UNITS 3—15 HP; NEW LABORATORY MILLS and CALENDERS; HPM 6" ram, 2500# pressure ACCUMULATOR; also Extruders, Mixers, Vulcanizers, Injection Molding Units, etc. UNIVERSAL HYDRAULIC MACHINERY COMPANY, INC., 285 Hudson Street, New York 13, N.Y.

1—NATIONAL 10"x20" two roll Mill with 25 HP motor; 1—Baker Perkins 100 gal. S.S. double arm jacketed Vacuum Mixer; 2—Baker Perkins, Readco 100 gal. jacketed double arm Mixers; 1—Baker Perkins 50 gal. double arm jacketed Mixer 50 HP motor; 4—Stokes Rotary Preform Presses DD2, DDS2, D4 and D3; 1—Kux Model 15-25 double action Rotary Press; Also: Sifters, Cutters, Banbury Mixers, etc., partial listing; write for details; we purchase your surplus equipment; BRILL EQUIPMENT CO., 2407 Third Ave., New York 51, N.Y.

AVAILABLE AT BARGAIN PRICES
Colton 2 RP and 3RP 10-35 Rotary & #5½ Tablet Machines. Rotex, Tyler Tum-mer, Selectro, Robinson, Raymond, Gayco, Great Western Sifters. Mikro Bantam, 1SH, 2TH, 3W, 4TH Pulverizers; Schutz O'Neill Mills. Baker Perkins Heavy Duty Steam Jacketed, Double Arm, from 12 to 200 gal., Mixers (Unidor and Vacuum also). J. H. Day, from ¾ up to 100 gal., Imperial and Cincinnatus D. A. Jacketed, Sigma Blade Mixers. Day, Robinson, Munson Dry Powder Mixers, 15 to 10,000 lbs., all sizes. F. J. Stokes RBB Rotary and R Tablet Machines. Package Machy. FA, FA4, Miller, Hayssen, Scandia, Oliver Auto. Wrappers. REBUILT AND GUARANTEED—This is only a partial list. Over 5000 machines in stock—available for immediate delivery. Tell us your machinery requirements. UNION STANDARD EQUIPMENT CO. 318-322 Lafayette St., New York 12, N. Y.

KUX 2½" dia. Single Punch Preform Machine. Hartig 1¼" Plastic Extruder. Leominster 8 oz. Injection Molding Machine complete late type. Plastic and Rubber Equipment. Farrel 16"x48", 15"x36" and 6"x12", 2 roll mills. Mills and Calenders up to 84". New Seco 6"x12" and 6"x 16" Lab. Mixing Mills and Calenders. Rubber & Plastic Extruders. 200 ton Hobbing Press 18"x 14" platens. HPM 200 ton 30"x48" Platens. New Loomis 340 ton, 24"x56" platens. 200 ton Brunswick 21"x21" Platens, 14" Ram. Southwark 30 ton 14"x14" platens, semi-auto. Elmes 75 ton 30"x36". Also Lab. to 2000 tons from 12"x12" to 48"x48" Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump 250#. W. S. 4 Plgr. High and Low Pressure Hydr. Pump. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs., Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & Single Punch Preform Tablet Machine ½" to 4". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins Jacketed Mixers. Plastic Grinders. Heavy duty mixers, gas boilers. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street, Brooklyn 15, N.Y. STerling 8-1944.

FOR SALE: 1—F.B. 32"x92" inverted-L 4 Roll Calender, reduction drive, d.c. vari-speed motor; 1—Royle #4 Extruder, motor driven. 1—6"x12" Laboratory Mill, m.d. 1—Ball & Jewell #2 Rotary Cutter, 15 h.p. motor. 3—#28 Devine Vac. Shelf Dryers, 19—59"x78" shelves, complete. 1—Farrel-Birmingham 6"x13" 3 Roll Calender. 3—Colton #5½ single punch Cabot machines, m.d. 1—Read-Standard 2000 lb. steel horizontal mixer. 1—Farrel 20"x22"x60" mill, top cap frame, falk reduction drive, 100 h.p. motor. 2—Farrel 16"x42" Mills with reduction drive and 100 h.p. motor. 4—Hymac 125 ton Molding Presses, 16"x16" electrically heated platens. Also other sizes: Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters. Send us your inquiries. What have you for sale? CONSOLIDATED PRODUCTS CO., INC., 50 Bloomfield Street, Hoboken, N. J. HOboken 3-4425. N. Y. Tel.: BArclay 7-0600.

FOR SALE: 60 oz. H.P.M. 48 oz. Lester, $45,000. 48 oz. DeMattia, new; 20 oz. Lester, new 1950, $16,000. 16 oz. H.P.M., $10,000. 16 oz. Reed-Prentice, 1950; 12 oz. Crown Moldmaster, $10,500. 12 oz. Watson-Stillman, excellent; 9 oz. H.P.M., $6,500. 8 oz. Reed-Prentice, double link, $6,500. 8 oz. Lester, 1949, $7,500. 8 oz. Leominster, $5,000. 6 oz. Reed-Prentice, $3,500. 6 oz. Lester, $4,000. 4 oz. Reed-Prentice, 1949, $4,750. 4 oz. Lester, 1951, $7,500. 4 oz. Impco, $8,000. 4 oz. Lester, $3,000. 4 oz. Lester vertical, $4,500. 4 oz. Acme, New; 2 oz. Reed-Prentice w/extra cyl. 2 oz. Watson-Stillman, vert., almost new; Ball & Jewell/Cumberland scrap grinders; 300 ton French Oil Mill press, $3,000. #235-A Stokes; 80 ton Transfer & Compression press, brand new, $4,250. 2½" Modern extruder; 2" Royle extruder; 3" cap. extruder; Compression plant near Boston, running successfully, owner retiring, $35,000. Molds: Party basket, 16 cav., $1,800; Lighthouse lamp w/material for 3500 pcs., $2,200; Hide-It Bathroom brush holder, $5,000. ACME MACHINERY & MFG. CO., 102 Grove Street, Worcester, Mass.

INJECTION PRESSES AT BARGAIN PRICES
16 oz. HPM Injection Presses for sale 2½ to 3 years old. Presses have been maintained in top notch working condition and can be seen in operation. They are skidded and ready for immediate delivery. This is an unusual opportunity for anyone in the market for equipment of this type.
Reply Box 2428, Modern Plastics.

FOR SALE: Hobbing Press 800 Ton W.S. (2) 300 Ton W.S. Presses 20x20 & 29x24 Platens. 140 Ton W.S. 22x16 Platen. 85 Ton Waterbury Farrel 20x24 Platen. 63 Ton Press 15x15 Platen with Pullback Cyls. 9, 8, 4, Oz. Injection Molding Machines. 15 Ton Lab. Presses 10x8 Platen. 10 Ton Lab. Presses 6x6 Platen. Ball & Jewell Plastic Grinders. Standard Mystic Embossing Presses, Accumulators, Pumps, Valves. Many other Presses—Send For Bulletin. AARON MACHINERY CO., INC., 45 Crosby St., New York 12, N. Y. Tel. WOrth 4-8233.

INJECTION MACHINES FOR SALE: 2, 4, 8, 10, 12, 16, 22, 24 and 32 oz. Reed-Prentice; 4, 12 and 48 oz. Watson-Stillman; 4, 9 and 16 oz. HPM; 4, 8 and 12 oz. Lester-Phoenix; 15 oz. Crown; 8 and 22 oz. Impco; 8 oz. Leominster; 16 oz. Munson; 12 oz. DeMattia; 2 oz. Van Dorn. Machines can be inspected in operation. Reply Box 2421, Modern Plastics.

FOR SALE: Injection Presses: 4, 8, 12, 16, 22 & 32 oz. Reed. 8, 12 oz. Lester. 9, 16, 40 oz. HPM. 1 oz. VanDorn.—2½" Extruder. Extruder conveyors. Small & large Scrapgrinders. Ovens. Compression & Transfer presses: 50, 100, 250, 500 tons. Laminating press with 5 op. 50x26" Plat.—Preform presses. 42" Slitt. & Rewind machine. 3 HP Gasboilers. Big Fiberglass press & oven. Equipment to be inspected in operation. List surplus equipment with me. JUSTIN ZENNER, 823 Waveland Ave., Chicago 13, Ill.

(5) NEW WATSON-STILLMAN EJECTION Molding Heating Chambers, one four ounce, one six ounce, two eight ounce, one sixteen ounce. Price one third the cost of new. New 75 ton presses, size 22x22, 10" ram, 10" stroke, $1100 each, ten day delivery f.o.b. Brooklyn, New York, one or more can be obtained. HYDRAULIC SAL-PRESS CO., INC., 388 Warren Street, Bklyn., N. Y.

FOR SALE: One-ounce Van Dorn Injection Machine; One-h.p. scrap grinder; Four-ounce DeMattia Injection Machine; Nine-foot fiberglass-steel boat Mold. Forced sale to clear space. Reasonable offer acceptable. W. R. BAILEY, 4346 Alton Place, N.W. Washington, D.C.

IMPCO COMPRESSION and Injection Machine 22 oz. Built 1946. Very Reasonably Priced. AARON MACHINERY CO., 45 Crosby St., New York, N.Y. WOrth 4-8233.

FOR SALE:
One twelve-ounce Lester Injection Molding Machine, type 3S-27-12, and one Lester twenty-ounce, type L3-15-20-LAS; excellent condition; can be seen in operation.
STERLING PLASTICS CO.
1140 Commerce Avenue, Union, New Jersey

FOR SALE: 1—Cumberland 14" rotary chopper; 3—Colton, Stokes Preform presses, 3" dia., 5—Ball & Jewell, Cumberland granulators, 1 HP to 15 HP; 1—NRM 2½" extruder, also presses, mixers, mills, etc. CHEMICAL & PROCESS MACHINERY CORP., 146 Grand St., New York 13, N.Y. Tel.: WOrth 6-3430.

SEYBOLD POWER PAPER CUTTING MACHINES 34" 39" 45" 57" 65" 75", 19" & 30" Hand Lever Cutters. Sheridan & Thomson Die Cutting Presses 14x22 20x30 18x32 22x44. Sheeters, Slitters, New, used. BARCLAY MACHINERY CORP., 175 Wooster St., New York. GR 7-8300.

(Continued on page 264)

CLASSIFIED ADVERTISING

(*Continued from page 262*)

HYDRAULIC PRESSES rebuilt, repaired. Used presses from laboratory to 1000 tons standard and special, molding and hobbing presses, etc. Used pumping units up to 10,000 p.s.i. all capacities. CLIFTON HYDRAULIC PRESS CO., 291 Alwood Rd. P.O. Box 325, Clifton, New Jersey.

DAY MIXER double arm "Z" type blade 100 gallon working capacity steam jacket wide range of speed 10 HP motor excellent condition. THE X-M COMPANY, 5631 Alexis Rd., Sylvania, Ohio.

FOR SALE: Embossing machine for plastic film light or heavy gauge. Can be used for laminating and polishing. Rolls 64" Face with dual let-off and dual take-up. 8 rolls for preheating train, electric controlled, three chill rolls, water cooled, J-box and friction take-up. T & M MACHINE & TOOL CO., 15 Greenpoint Ave., Brooklyn 22, N.Y. Tel.: EV 9-1964.

FOR SALE: Stainless Steel Rotary Dryer, Link Belt Co., 5'2"x16', No. 502-16, with all auxiliary equipment. Roto Louvre type. Reply Box 2434, Modern Plastics.

FOR SALE: 1946-9 oz. & 16 oz. HPM reasonably priced. AMERICAN MOLDING CO., 355 Fremont St., San Francisco, Calif.

INJECTION MOLDING MACHINES: 22 oz. I.P.M. Late Watson-Stillman 8 oz. H.P.M. 9 Oz. AARON MACHINERY CO., Inc., 45 Crosby St., N.Y.C. WO 4-8233.

BALL & JEWELL ROTARY CUTTER #1 complete with fly wheel, pulley, hopper and blades. Very reasonable. THE BLANE CORP., Canton, Mass.

MACHINERY and EQUIPMENT WANTED

WANTED: Machinery including Rubber Mills, Hydraulic presses, Sturdy mixers, Calenders, Banbury mixers, Pulverizers, Grinders, Rotary cutters, Extruders, Screens, Injection Molding machines, Dryers. Will purchase complete plant. CONSOLIDATED PRODUCTS CO. INC., 50 Bloomfield Street, Hoboken, N.J. HOboken 3-4425. N. Y. Tel.: BArclay 7-0600.

WANTED—Used Presses, 30" x 54" minimum Platen, 500 ton minimum pressure—prefer french oil, advise price, make, condition, etc. Reply Box 2407, Modern Plastics.

WANTED: 8 oz. Injection Molding Machine, No. 3 Banbury Mixer, Calender, Extruder. Give particulars. Reply Box 2435, Modern Plastics.

MATERIALS FOR SALE

FOR SALE: 20,000 lbs. each Red and Blue Styrene Pellets. Surplus lot Red Acetate Pellets—15,000 lbs. Both attractively priced. We are also in the market for all surplus plastic scrap and powder. FRANKLIN JEFFREY CORPORATION, 2004 MacDonald Avenue, Bklyn., N. Y. Tel.: ES 5-7943.

FOR SALE: Rigid Vinyl Scrap, 10,000 lbs. of clear, 10,000 lbs. of white, 20,000 lbs. of assorted colors—per month. All segregated, clean and free of contamination. Samples and quotations upon request. Reply Box 2423, Modern Plastics.

MATERIALS WANTED

VACUUM FORMERS MOLDERS FABRICATORS
Sell us your scrap and rejects—
Top Prices Paid for Any Quantity.
CLAUDE P. BAMBERGER, INC.
152 Centre Street, Brooklyn 31, N.Y.
Tel.: MAin 5-5553
Not connected with any other firm of similar name.

SCRAP PLASTICS, all forms, waste and surplus plastic molding materials, rejects in any form. We will also buy your obsolete inventories of molding powders, stabilizers, plasticizers and other plastic and chemical materials. ACETO CHEMICAL CO., INC., 40-40A Lawrence St., Flushing 54, N.Y. INdependence 1-4100.

WANTED: Plexiglas and Lucite scrap, salvage and cut-offs, any quantity. DUKE PLASTICS CORP., 406 Atlantic Ave., Bklyn. 17, N.Y. ULster 8-9413.

WANTED—Acetate .020 gauge rolls, Red, Green, Blue and Yellow. Minimum width 4-¼". Send sample and quote best price to:—WILLIAM A. CROOK COMPANY, 36 Pleasant Street, Watertown, Mass.

MOLDS FOR SALE

FOR SALE: Ships steering wheel mold, produces four complete wheels. Fifteen second cycle. Individual weight per item—18 grams. Dimensions of wheel five inches in diameter with eight spokes. May be used as wall plaque, coaster, souvenir, etc. Full particulars by mail. This item is NEW and has never been commercialized. Price: $1,500. Contact: MR. PAUL J. ANDONIAN, 1 Kingsbury Street, Worcester 3, Massachusetts.

HELP WANTED

PRODUCT DEVELOPMENT ENGINEER PLASTICS
Nationally prominent raw materials supplier in the Plastics Industries requires a Product Development Engineer, to age 35, with experience in the fabrication of reinforced plastics. Applicants should have a degree in engineering or equivalent with a good knowledge and background in polyester resins. Special experience in the fields of matched metal mold work, bag molding, molding of premix compounds, and molding putties is desirable and preferable.
Position located in NORTHERN N.J. with good salary and liberal benefits. Submit complete resume including age, education, experience, salary requirements.
Box MP 1633, 221 W. 41 St., N. Y. 36, N.Y.

REINFORCED PLASTICS ENGINEER. Excellent opportunity for a young Chemical Engineer graduate with a leading reinforced plastics fabricator. Some experience with design and production of reinforced plastics utilizing high polymer resins and fiberglas would be desirable. Initial responsibilites will be as a Project Engineer on defense and commercial products. Several fabricating techniques are employed such as matched metal or bag molding of preforms and various sandwich constructions. This position offers security, good pay and opportunity for advancement with a reliable, expanding firm. Send resume to Box 2422, Modern Plastics.

PLASTICS EXECUTIVES—$5,000 to $25,000. We have immediate openings with leading national concerns for competent men in all phases of the Plastics industry. Rapid, confidential, nationwide service. For application, send your name and address to: E. B. Shea, Plastics Industry Division, DRAKE ENGINEERING PERSONNEL, 7 West Madison Street, Chicago 2, Illinois.

VINYL CHEMIST
Experienced on heavy or light gauge calendering. All replies handled in strictest confidence.
Reply Box 2406, Modern Plastics.

DIRECTOR FOR RESEARCH AND PRODUCT DEVELOPMENT. Rapidly expanding plastics firm in Chicago area desires man preferably with degree in mechanical engineering to direct Research and Product Development Department. Good knowledge of the chemistry of thermoplastics as applied to injection molding, extrusion, and vacuum forming desirable. Must have creative ability and good background of experience in connection with the plastics industry and capable of customer contact. Submit complete resume and salary requirements to R. J. Olson, FEDERAL TOOL CORPORATION, 3600 W. Pratt Blvd., Chicago 45, Illinois.

ASSISTANT FOR SALES MANAGER. Established and growing firm in New York City area. Chemical training and sales experience essential. Plastics and plasticizer knowledge desirable. Please give qualifications and experience. Reply Box 2426, Modern Plastics.

A YOUNG AGGRESSIVE COMPANY with proven record located in the Middle South Atlantic States wishes to establish a Plastics Moulding Division. We need an aggressive, competent man to head this Division. An excellent opportunity for a man who wants to get ahead in his field. Send resume of qualifications, experience, and salary expected. Reply Box 2414, Modern Plastics.

WANTED:—An experienced extrusion man, capable of die work, set-up work, etc. Growing concern, excellent chance for advancement, location north of Boston. Replies held in strictest confidence.
Reply Box 2410, Modern Plastics.

SALES ENGINEER—Large Mid West injection molder wants experienced men to call on custom molding industrial accounts. Small and large castings—engineering, tool rooms, vacuum plating, painting, hot stamping, silk screen and assembly. Quality, on time delivery and competitive prices. Permanent connection. Give details of territory and experience—our men know of this ad. Reply Box 2400, Modern Plastics.

TECHNICAL SERVICE MANAGER. Thoroughly experienced in injection and compression molding. Must have chemical and mechanical background, and proven ability to supervise personnel. Excellent opportunity for an aggressive and energetic man interested in an executive position with a large molding company. State experience, references, and salary dsired. All correspondence will be kept confidential. Reply Box 2404, Modern Plastics.

OUR SUCCESSFUL GROWTH and EXPANSION opens the door to opportunity for an experienced custom injection molding sales engineer. Consideration will be given to the proven sales record, established contacts, account control commanded, conversance with finishing operations and technical ability. Correspond immediately to JAMISON PLASTIC CORPORATION, 1255 Newbridge Rd., North Bellmore, L. I., N. Y.

PLASTICS ENGINEER. Major packaging firm has opportunity for Plastics Engineer with mechanical engineering degree and ability to develop devices, methods and procedures in field of packaging and plastic containers and fitments. Knowledge of, and experience with, properties of plastics and chemical materials necessary. Job requires creative thinking in packaging assignments and developing new ideas and techniques. Must have ability to meet people and represent firm in customer consultant contacts. Training program provided to supplement previous experience. Reply Box 2409, Modern Plastics.

(*Continued on page 266*)

From sturdy fishing rods to handy soup kitchens!

Pittsburgh Selectron

POLYESTER RESINS

Now Ready For A Thousand New Uses

PITTSBURGH SELECTRON Resins have opened new opportunities for much greater product usefulness with reduced manufacturing costs.

When combined with suitable fillers these remarkable resins have been used to mold products that are lighter than aluminum with strength-weight ratios and impact resistance surpassing those of any other known materials. They also provide unusual resistance to weather, sunlight, heat, abrasion and many chemicals.

That's why SELECTRON Resins are today being used in a wide range of products. These can be as different in size, shape and weight as the new "glass" fishing rods so popular among anglers and the modern displays used in Heinz Fast-Food Kitchens. These displays were designed by the Milwaukee Industrial Designers, of Milwaukee, Wisconsin, and molded by G. B. Lewis, of Watertown, Wisconsin.

SELECTRON Resins are of the thermo-setting type. They polymerize to form solids with or without heat and with or without pressure. Parts in which they are used can be molded either by hand lay-up, direct molding, continuous lamination or pre-forming. These resins can also be used without fibers for casting, potting and impregnating.

We'll be glad to have one of our engineers discuss your problems with you without cost or obligation. This may save you time and money.

Send For FREE Booklet!

Write, wire or phone today for our new booklet containing descriptions of SELECTRON Resins and explaining many of the ways in which they can be used. Pittsburgh Plate Glass Company, Selectron Products Division, Gateway Center, Pittsburgh, Pa.

Just a few products in which Pittsburgh SELECTRON Resins are now used—

Aircraft structural parts
Radomes for electronic equipment
Life floats
Ballistic panels
Helmets
Boat hulls
Machinery housing and guards
Trays
Tote boxes
Food lockers
Garbage pails
Baskets for automatic dishwashers
Baskets for automatic washers
Wash tubs
Tool chests
Shipping containers
Instrument cases
Laundry hampers
Kitchen containers
Fishing rods
Sinks
Street signs
Traffic signs
Fluorescent light fixtures
Television cabinets
Loudspeaker housings
Gas meter housings
Structural panels for offices and homes
Door and transom lights
Awnings and canopies
Greenhouse panels
Skylighting
Molded chairs
Prefabricated houses and garages
Truck bodies

PITTSBURGH Selectron

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

CLASSIFIED ADVERTISING

(*Continued from page 264*)

TOOL DESIGNER
For plastic molds with 10 to 15 years experience. Knowledge of injection molding equipment desired. Excellent opportunity with well established proprietary molder in Greater New York area. Please furnish complete resume and state salary desired. Reply Box 2411, Modern Plastics.

SALES DEVELOPMENT. Excellent opportunity in sales development and technical service of polyethylene. Experience required in techniques of producing film, sheeting, wire coating, and pipe. Position will require traveling. Kindly include full details of experence, education, personal data, and salary requirements in first letter. Reply Box 2420, Modern Plastics.

WHERE IS THE INJECTION MOLDING ENGINEER who can fit this job? He has a terrific future with us, but he must have: Energy & Resourcefulness to see a job through no matter what obstacles stand in the way. The job comes first—regardless of the time. Intelligence & Superior Mechanical Ability—Must be willing to get his hands dirty. Technical Knowledge in all phases of injection molding: time study; setting cycles; quotation work, including calculating volumes from blueprints; finishing: painting and assembly operation; inspection and quality control. Leadership—Knows how to bring out the best in people to get the job done. Our plant is growing very rapidly. We are located in Virginia. You have an opportunity to grow with us as a key man with profit participation, but you have to be really good to qualify. Salary will be attractive. Write in confidence—President. Reply Box 2413, Modern Plastics.

EXCELLENT OPPORTUNITY open for Chemist experienced in manufacture of Polyvinyl Acetate Emulsions or formulation and manufacture of Synthetic Resin Adhesives. Write fully stating experience, background, etc. Reply Box 2432, Modern Plastics.

EXTRUSION SUPERINTENDENT—Leading extruder in Newark, N. J., area wants experienced technician to take charge of plant specializing in acrylics and acetate. Complete familiarity with dies, compounding, coloring, all other phases. Write experience, salary required. Reply Box 2427, Modern Plastics.

PROGRESSIVE MANUFACTURER in South America wishes to hire technician for installation of slush molding division. Good salary and good conditions. Payment in Dollars. Interviews in New York. Reply Box 2416, Modern Plastics.

DESIGN AND DEVELOPMENT ENGINEER
Permanent opportunity for a young graduate engineer to participate in an expanding engineering program of a large progressive multi-plant manufacturer. Applicants should have experience in production methods and tool design, particularly with plastics material, although allied industry experience will be considered. Location in Essex County, N. J. Send complete information including experience, education, age and salary expected.
Box MP 1634, 221 W. 41 St., N. Y. 36, N. Y.

WANTED—Experienced salesman now calling on users of injection molded plastics products. We can run customer owned molds or will build new molds for volume items. Reply Box 2403, Modern Plastics.

ENGINEERING ASSISTANT—Familiar with design of injection and compression moulds, for position involving mould procurement and estimating. Growing, medium size moulding concern in Southern Massachusetts. All replies confidential. Write stating experience and starting salary desired. Reply Box 2408, Modern Plastics.

CHIEF ENGINEER—PLASTICS. Established company, experienced. Full responsibility for all engineering operations including mold design, tool estimating, placement of tooling, fixture and machine design, development of manufacturing techniques, and product development for injection molding. Vacuum forming experience helpful. Large operation—salary open. Confidential—let's talk it over. Reply Box 2401, Modern Plastics.

CHEMIST OR CHEMICAL ENGINEER: Midwest injection, compression, and transfer molder requires person for research and development work involving materials and products. Excellent opportunity for advancement. Send complete resume, salary expected, and recent photograph. Reply Box 2412, Modern Plastics.

SITUATIONS WANTED

LOOKING FOR a cost-conscious Plant Manager to assume full responsibility for running your Injection Molding Plant efficiently? Presently employed as Plant Superintendent of twenty press shop, I have ten years thorough experience in all phases of operations, from raw ideas to packaged product, through Technical Service, Design, Molding, Finishing and Quality Control. Prefer Los Angeles or Chicago location. Reply Box 2418, Modern Plastics.

MACHINE DESIGNER, qualified mechanical engineer, 35, desires responsible position with substantial concern United States or Canada. Long varied experience design and manufacture of automatic machinery in engineering and plastics industries, and development of plant and methods for new processes. At present Design Executive with major plastic moulding company in England. Fullest details and references available. Reply Box 2419, Modern Plastics.

VINYL CHEMIST—B.S., Age 34, 12 years experience in formulation evaluation and competitive analysis in all phases of vinyl compounding. Dry blends and conventional extrusion compounds, plastisols, surface coatings, adhesives, sealers. Equally competent in production and development. Reply Box 2424, Modern Plastics.

EXECUTIVE AVAILABLE: Canadian, age 48, Over 20 years Experience Coated Fabric, Vinyl Film, Rubber Industry as Sales and General Sales Manager and General Products Manager. Early experience 12 years financial, member stock exchange (Toronto). Would be interested in guiding medium sized organization in the above or allied fields. Would reside anywhere in United States. Reply Box 2433, Modern Plastics.

SALES ENGINEER, 15 years experience Automotive and Refrigeration industry, to represent Injection Molder equipped to do precision Nylon and Finished Refrigeration parts. Reply Box 2405, Modern Plastics.

SALES AGENTS WANTED

SALES AGENTS WANTED. Progressive Canadian Injection Molder wants sales agents for all territories in the United States. We have an unusual line of plastic containers produced by a new molding technique. Our prices are competitive in spite of customs duties. Reply stating territory and types of outlets you best cover. Liberal commission arrangement. Literature available. Reply Box 2425, Modern Plastics.

SALESMAN OR MANUFACTURER'S REPRESENTATIVE wanted for Northern New Jersey territory by a large Eastern Injection Molder. Outstanding Tool Room Facilities, Finishing, etc. Commission basis. Reply in confidence. Reply Box 2431, Modern Plastics.

MANUFACTURER'S REPRESENTATIVE to sell extruded Plastic items, such as Tubing, Rods, Strip, Shapes, etc., to industrial accounts. Agents wanted primarily in Illinois, Michigan, Ohio, Pennsylvania, and New York State areas. ERIE PLASTICS COMPANY DIV. OF ERIE IRON & SUPPLY CORPORATION, 1059 Bufialo Road, Erie, Pa.

MANUFACTURER'S SALES REPRESENTATIVE, now calling on Industrial and Consumer accounts wanted by progressive injection molder. Up to 16 oz. capacity. All powders molded including Nylon. Complete cooperation. Plant located in New York area. Reply Box 2429, Modern Plastics.

MISCELLANEOUS

WANTED
Plastic Injection Molding Plant engaged in proprietary or custom molding, doing one half million to one million annual sales. Cash or suitable terms. All replies confidential.
Reply Box 2430, Modern Plastics.

BOOKS AND MAGAZINES, New or Out-Of-Print Supplied. Encyclopedias and sets. That Hard-To-Get Book or Magazine you want can be obtained by our search service. Back numbers of Modern Plastics, Scientific Magazines, National Geographics located. Send us your want list. We will quote without obligation. Books of all Publishers Supplied Promptly. PERIODICAL SERVICE, Box 465-PL, Wilmington, Delaware.

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DECEMBER 1954

Plastic parts for Ansco cameras are produced on this mold of Crucible CSM 2 by Sylvania Electric Products, Inc. The mold designer and builder was Alex Primas.

Intricate mold of

CRUCIBLE CSM 2

forms Ansco camera parts

This intricate six-cavity mold of Crucible CSM 2 mold steel produces small plastic parts for the flash holder of an Ansco camera.

It's an exacting molding operation, for the parts must be perfectly uniform and interchangeable. Success of the job depended upon a combination of excellent mold and part design, skilful mold building and mold operation and mold steel of the highest quality. That's why Crucible CSM 2 tool steel was chosen.

Whether your application requires a mold as complex as this one, or one of several tons, you can rely on Crucible. For Crucible mold steels are actually tool steels . . . produced in the country's foremost tool steel mill. So check with your Crucible representative. He can tell you how Crucible CSM 2 fits your job, and see that it's shipped *fast* from local stocks.

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CRUCIBLE first name in special purpose steels

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Chemicals you live by

Dry-blend faster, better with Diamond PVC-50

This is DIAMOND PVC-50 *after blending with plasticizers, stabilizer and lubricant. Notice the free-flowing character of the dry blend and the absence of caking and agglomerates.*

Comparative tests show that DIAMOND PVC-50 has exceptionally good dry-blending properties. The uniform high quality of DIAMOND resin permits ready absorption of the plasticizers and produces a free-flowing mixture that does not cake or ball-up, even when stored or shipped prior to processing.

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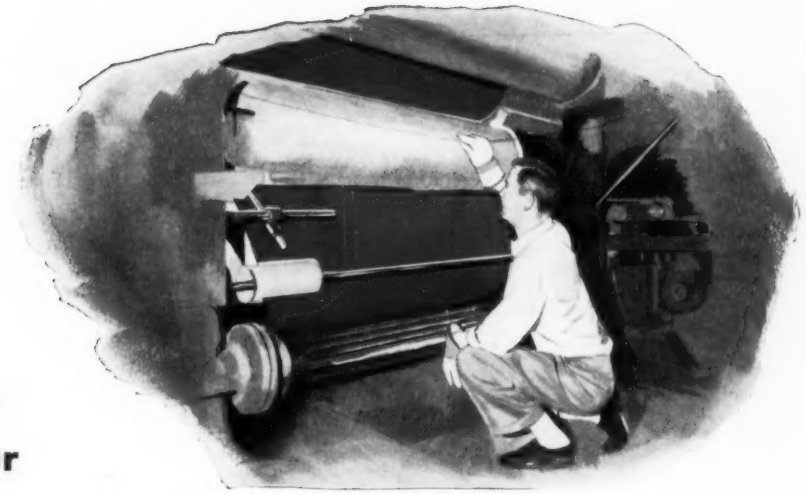

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At no extra cost, you can solve your

High Processing Heat

or *Permanence* **problems with**

New PITTSBURGH PX-118 IODP

IF high processing heat or extraction is a problem on your vinyls, you'll welcome the news that high-permanence IsoOctyl Decyl Phthalate is now available from a *basic* producer!

New Pittsburgh PX-118 IODP provides—at no extra cost—outstanding performance in high temperature processing cycles and in calendering and coating operations where large surface areas are exposed—thanks to its low volatility and high permanence.

Vinyls made with Pittsburgh PX-118 are characterized by long life and excellent resistance to extraction—properties that are especially important in sheeting, coated fabrics, extruded tubing, refrigerator gaskets and electrical jacketing.

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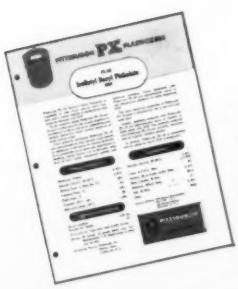

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